

# PERMANENT WAY ROLLING STOCK

AND  
TECHNICAL WORKING

OF

## RAILWAYS

WITH AN APPENDIX ON WORKS

BY

### CH. COUCHE

INSPECTEUR GÉNÉRAL DES MINES, PROFESSEUR DE CONSTRUCTION ET DE CHEMINS DE FER A L'ÉCOLE DES MINES,  
PRÉSIDENT DE LA COMMISSION PERMANENTE DES RÈGLEMENTS ET DES INVENTIONS CONCERNANT LES CHEMINS DE FER,  
PRÉSIDENT DU COMITÉ CONSULTATIF DES MACHINES A L'EXPOSITION UNIVERSELLE DE 1878, ET DE LA CLASSE 64  
(MATÉRIEL DES CHEMINS DE FER) DU JURY INTERNATIONAL, ETC.

---

### VOLUME II WITH ATLAS OF 109 PLATES

TRANSLATED FROM THE FRENCH BY

#### J. EDWARDS WILSON

LATE ENGINEER IN CHIEF ODDU AND ROHILKUND RAILWAYS

— ATLAS —

Vol. II, in-quarto, with Atlas.—Price £ 5.—The Whole to be completed in four Volumes.

DULAU & Co  
37, SOHO SQUARE  
LONDON

DUNOD, ÉDITEUR  
QUAI DES GRANDS-AUGUSTINS 49,  
PARIS

1878

The rights of translation and reproduction are reserved



# PLATES

TO THE

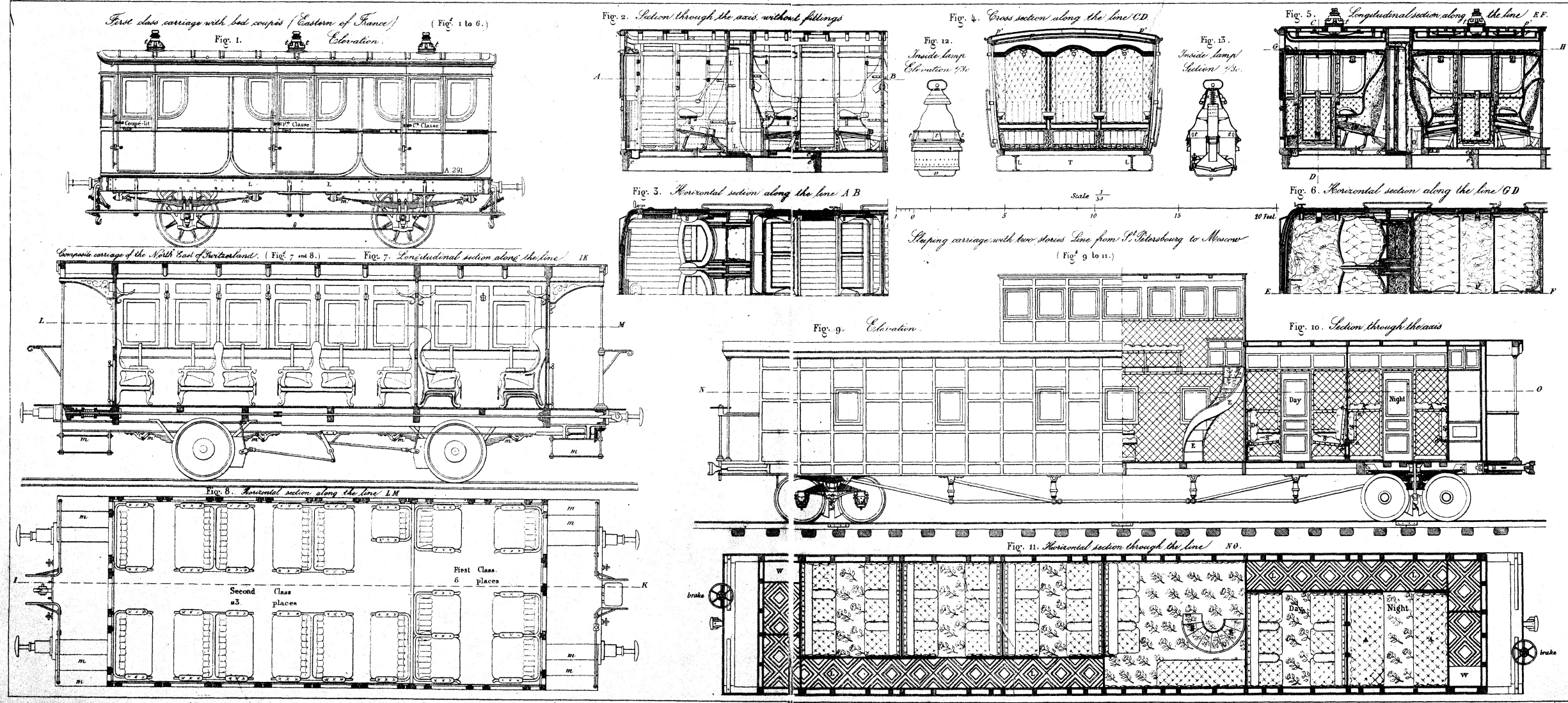
## SECOND VOLUME

### ROLLING STOCK AND TRACTION

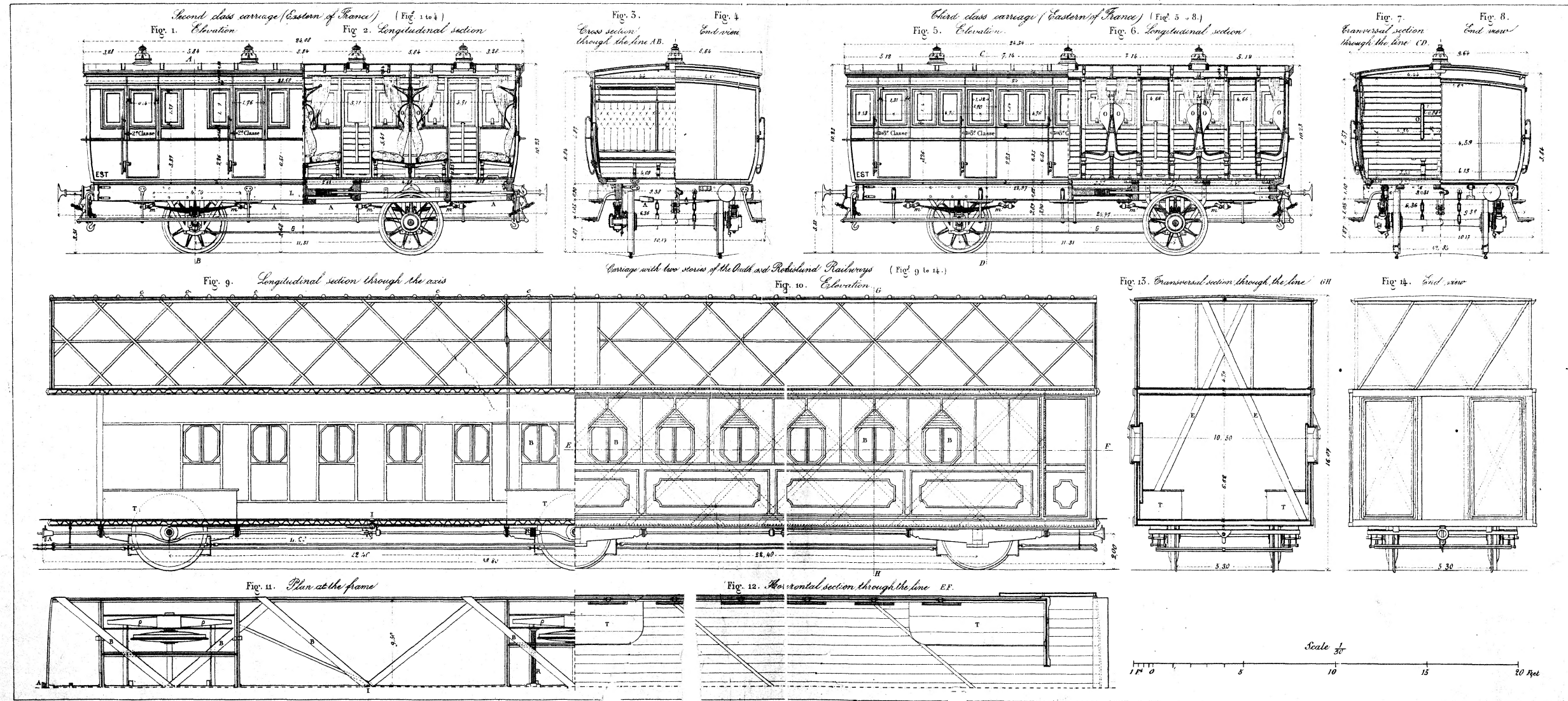
- Pl. I, II and III . . . . . — Passenger-carriages.  
 Pl. IV . . . . . — Passenger-carriages. — Carriages with double stories.  
 Pl. V, VI and VII . . . . . — Passenger-carriages. — Platforms.  
 Pl. VIII . . . . . — Passenger-carriages. — With passage down the middle. — With beds.  
 Pl. IX . . . . . — Details. — Coupling. — Heating. — Ventilation.  
 Pl. X . . . . . — Details. — Frames.  
 Pl. XI . . . . . — Details. — Springs. — Suspension.  
 Pl. XII . . . . . — Axle-boxes. — Axles. — Wheels. — Tyres.  
 Pl. XIII . . . . . — Vans. — Carriages for lines with very sharp curves.  
 Pl. XIV . . . . . — Luggage-vans. — Horse boxes. — Cattle-trucks. — Open trucks.  
 Pl. XV . . . . . — Goods waggons.  
 Pl. XVI . . . . . — Goods waggons. — Open waggons. — Platforms. — Oil axle-boxes.  
 Pl. XVII . . . . . — Coke waggons. — Timber trucks. — Cranes.  
 Pl. XVIII . . . . . — Locomotives. — Details. — Sand-boxes. *Hall's crank*. — *M. Caillet's* apparatus.  
 Pl. XIX . . . . . — Locomotives with four wheels.  
 Pl. XX . . . . . — Locomotives with four wheels coupled.  
 Pl. XXI . . . . . — Locomotive with four wheels.  
 Pl. XXII and XXIII . . . . . — Locomotives with six wheels uncoupled.  
 Pl. XXIV . . . . . — Locomotive express with six wheels, four coupled, by *Börsig*.  
 Pl. XXV to XXVII . . . . . — Locomotive with six wheels, four coupled, by *Sigl* (line from *Warsowie* to *Terespol*).  
 Pl. XXVIII and XXIX . . . . . — Locomotive with six wheels, four coupled, alteration (*Paris-Méditerranée*).  
 Pl. XXX to XXXII . . . . . — Locomotive with six wheels, four coupled, high speed (Northern of France).  
 Pl. XXXIII and XXXIV . . . . . — Locomotive with six wheels, four coupled, high speed, *Martin's* axle. (Western of France).  
 Pl. XXXV to XXXVII . . . . . — Locomotive with six wheels, four coupled high speed (*Orléans*).  
 Pl. XXXVIII to XL . . . . . — Locomotive with six wheels coupled (*Midi*).  
 Pl. XLI and XLII . . . . . — Locomotive with six wheels coupled (Western of France).  
 Pl. XLIII to XLV . . . . . — Locomotive with six wheels coupled. — Tank-engine with driving wheels behind. (Western of France).  
 Pl. XLVI and XLVII . . . . . — Tank-engine with six wheels coupled, constructed at the *Creusot*.  
 Pl. XLVIII . . . . . — Locomotive with eight wheels coupled (*Orléans*).  
 Pl. XLIX to LII . . . . . — Locomotive with eight wheels coupled (Northern of Spain).  
 Pl. LIII and LIV . . . . . — Locomotive with eight wheels coupled, by *Sigl* (line from *Moscow* to *Koursk*).  
 Pl. LV to LVII . . . . . — Tank-engine, with eight wheels coupled, by *André Kœchlin* (*Paris-Ceinture* line).  
 Pl. LVIII to LX . . . . . — Locomotive with twelve wheels coupled (*Orléans*).  
 Pl. LXI and LXII . . . . . — Locomotive with twelve wheels coupled, and with four cylinders (Northern).  
 Pl. LXIII . . . . . — Tank-engine with-bogie truck. — Goods engines by the *Société Saint-Léonard* (line from *Santander* to *Alar del Rey*. — *Hartmann's* engine with *Bissel* truck.

- Line from *Santos* to *Jundiaby* (Brésil).











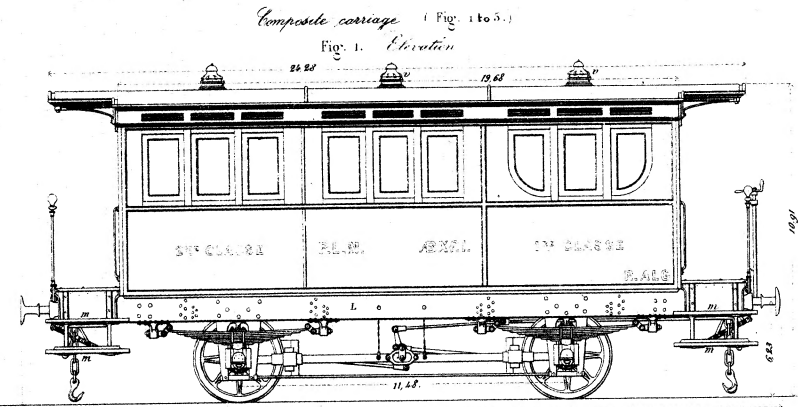


Fig. 2. Longitudinal section through the line ABCDEF. (of Fig. 5.)

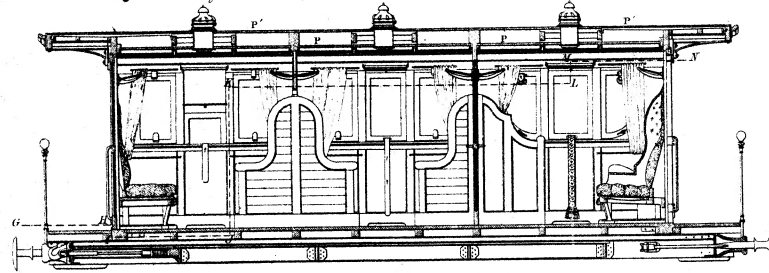


Fig. 3. Horizontal section through the line GHIJKLMN. (of Fig. 2.)

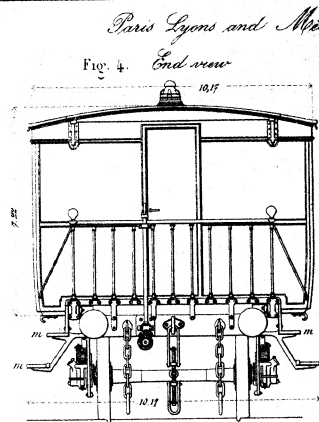
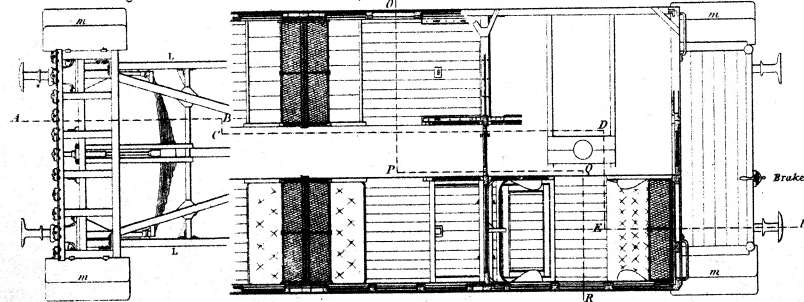


Fig. 5. Cross section through the line OPQR. (Fig. 5.)

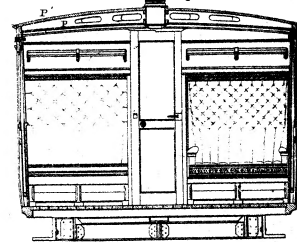


Fig. 11.

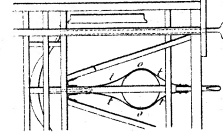
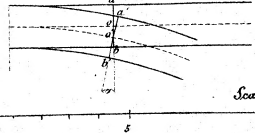


Fig. 12.



Scale for fig. 12

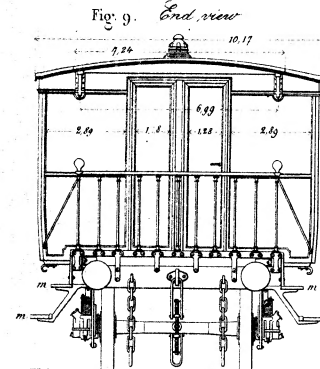


Fig. 10. Cross section through the line XY. (Fig. 8.)

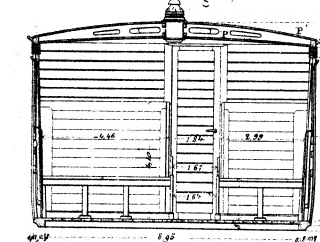


Fig. 13.

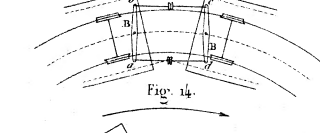


Fig. 14.

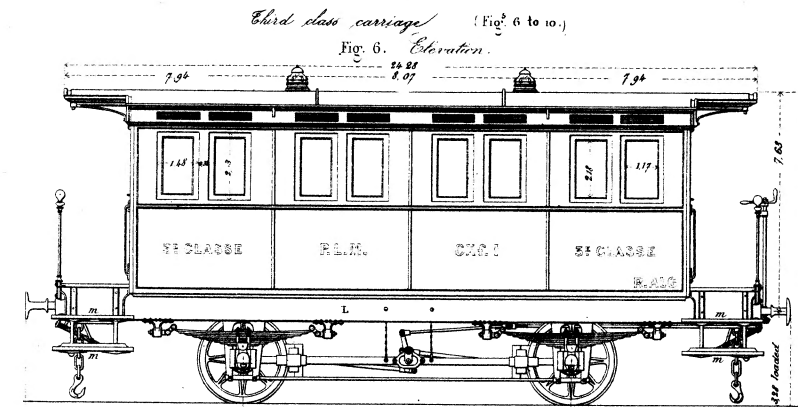
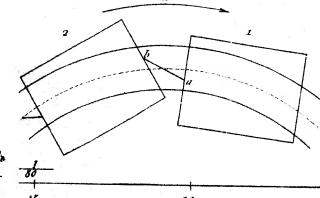


Fig. 7. Longitudinal section through the line STUV. (of Fig. 8.)

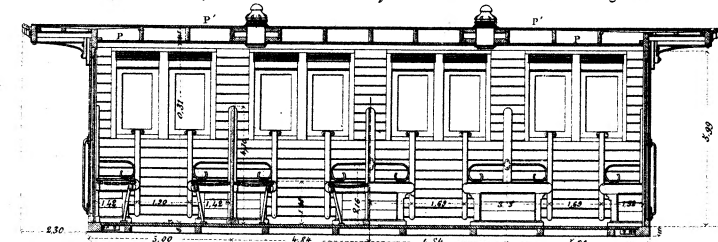
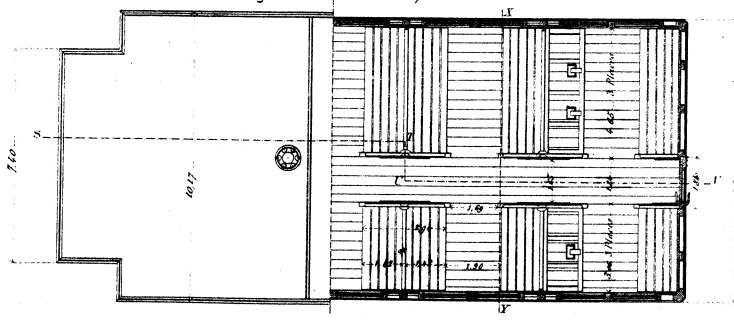
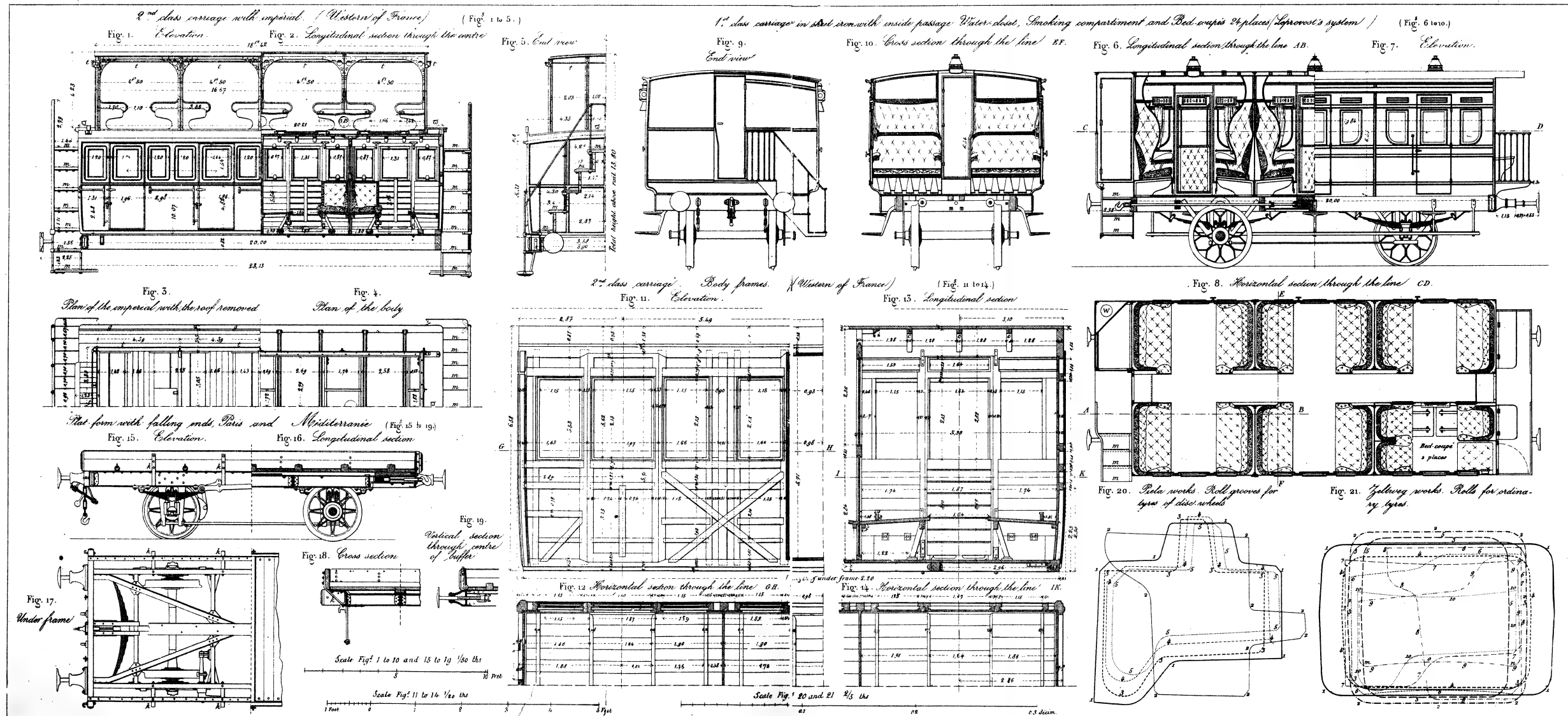


Fig. 8. Horizontal plan and section











1<sup>st</sup> class carriage with double suspension M. Reifert's (Fig. 1 to 5.)  
(Wien-Lemberg railway)

Fig. 1. Elevation.

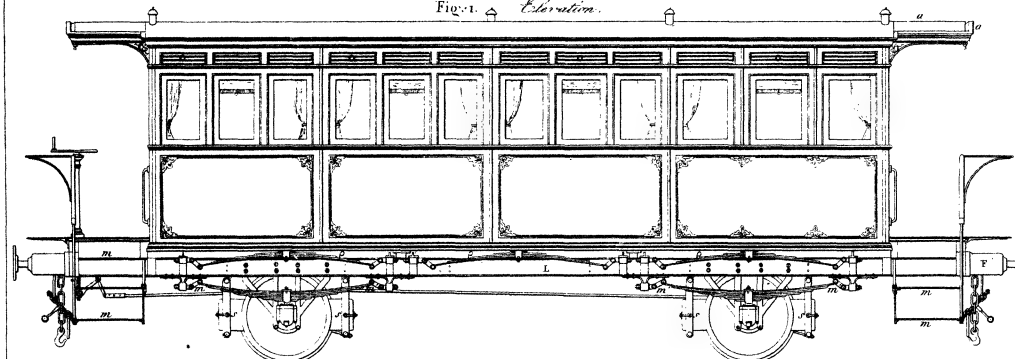


Fig. 2. Longitudinal section.

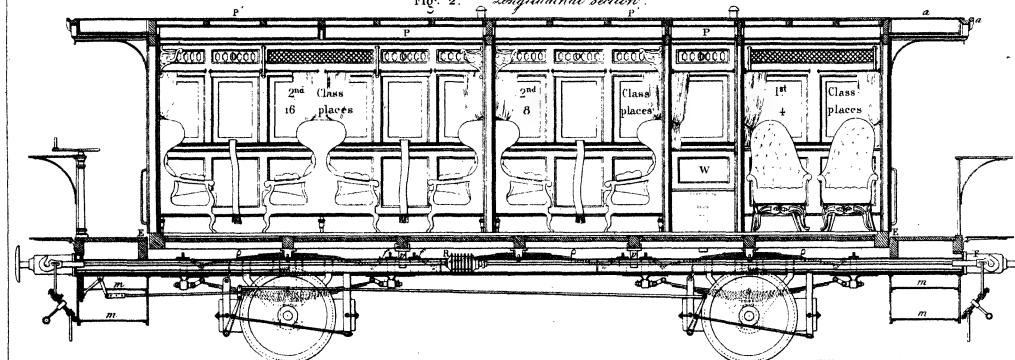


Fig. 3. Plan of the under frame.

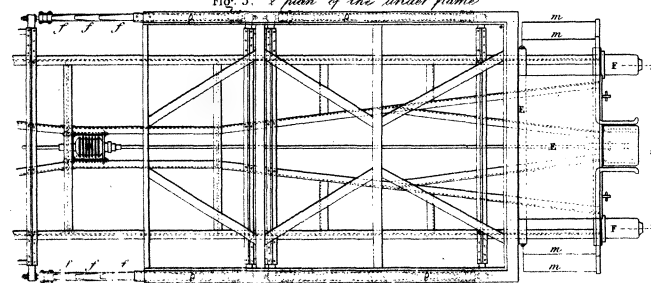


Fig. 4. Elevation.

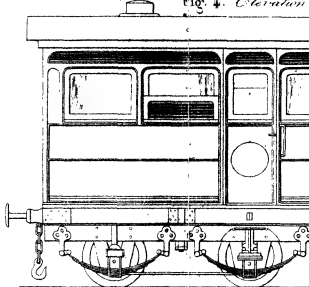


Fig. 5. Longitudinal section.

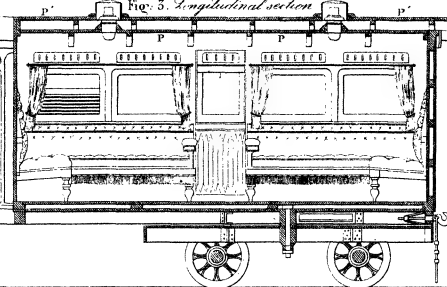


Fig. 6. End view.

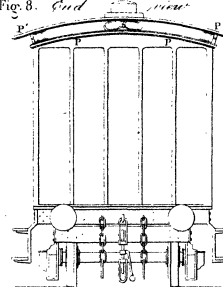


Fig. 7. Cross section.

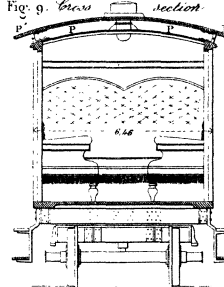


Fig. 6. Plan of the under frame.

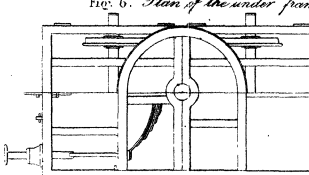
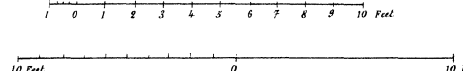
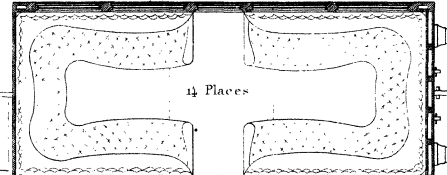


Fig. 7. Horizontal section.



Saloon carriage of the Great Western broad gauge.  
(Fig. 12 and 13.)

Fig. 12. Elevation.

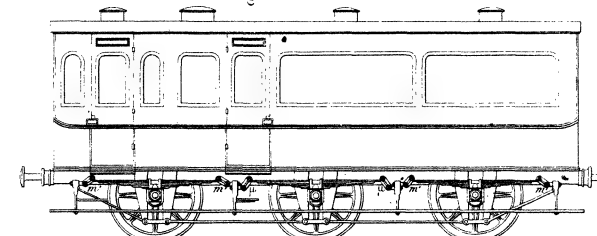


Fig. 13. Horizontal section.

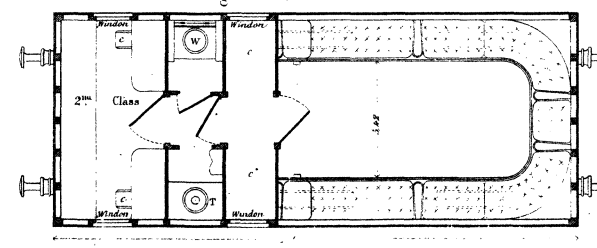


Fig. 10. Royal saloon carriage, Upper Italy. Horizontal section.

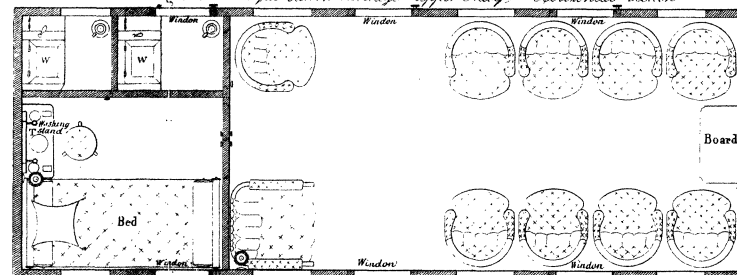
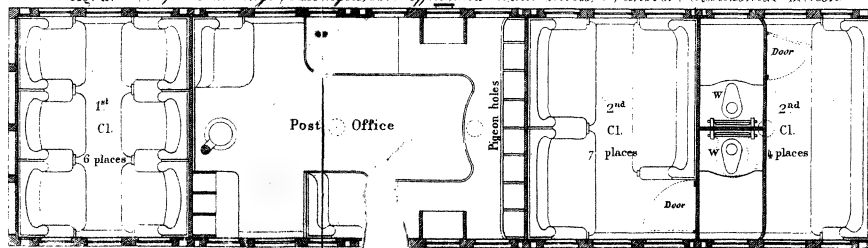


Fig. 11. Composite carriage (Passenger, Post Office and Water levels, Hanover). Horizontal section.





Composite carriage 1<sup>st</sup> and 2<sup>nd</sup> class with longitudinal compartments with beds  
of the Austrian Staats-Bahn (Fig. 1 to 3.)

Fig. 1. Longitudinal section and elevation

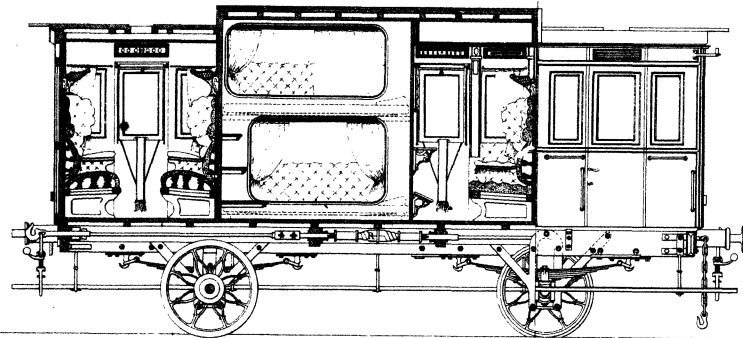


Fig. 3.  
Cross section  
through the axis of the bed compartments

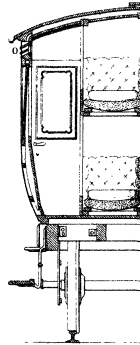
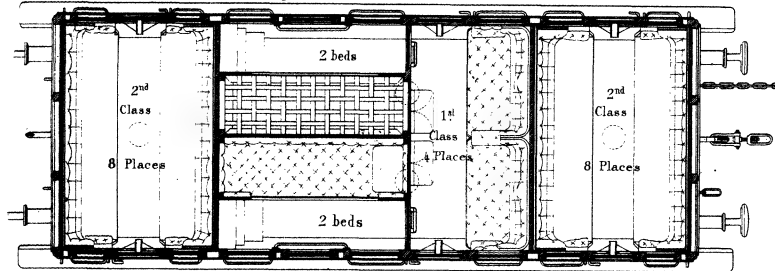
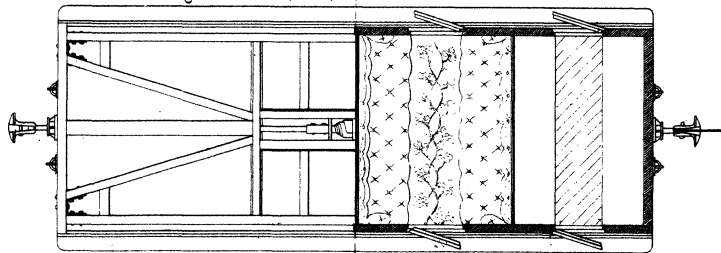


Fig. 2. Horizontal section

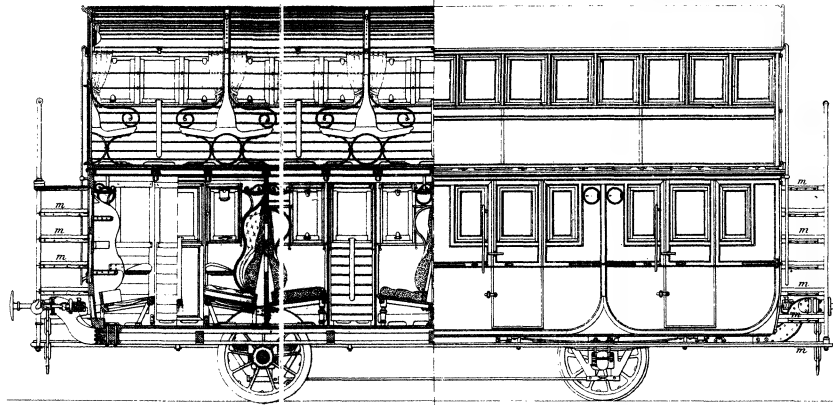


Composite carriage of the Norwegian lines (gauge 330)  
Fig. 11. Plan of the frame horizontal section



Composite carriages

Fig. 4. Longitudinal section through the axis



Composite carriage with two stories (Eastern of France) (Fig. 4 to 10.)

Fig. 5. Elevation

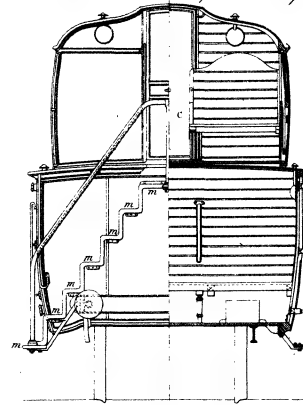
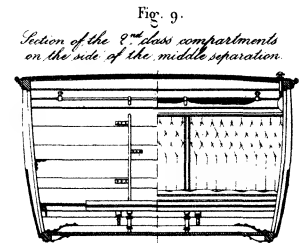
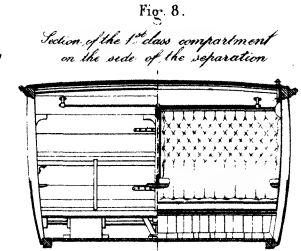


Fig. 6.  
Elevation  
End view

Fig. 7.  
Section of the 3<sup>rd</sup> class  
(compartments)



Composite carriage of the Lombard line (Fig. 12 to 15.)

Fig. 12. Elevation

Fig. 13. Longitudinal section through the axis

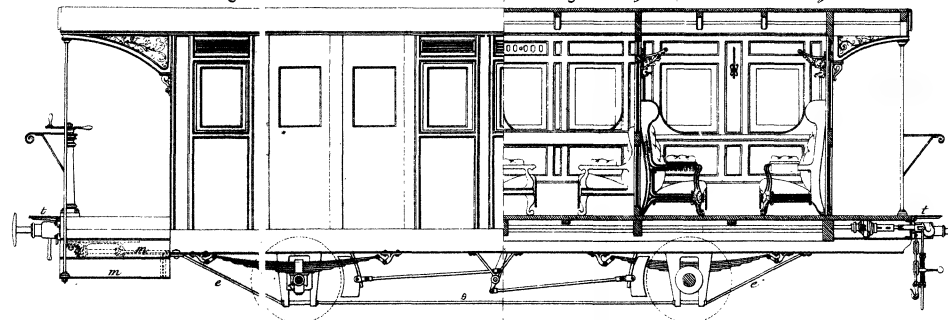


Fig. 14. Plan of the frame

Fig. 15. Horizontal section

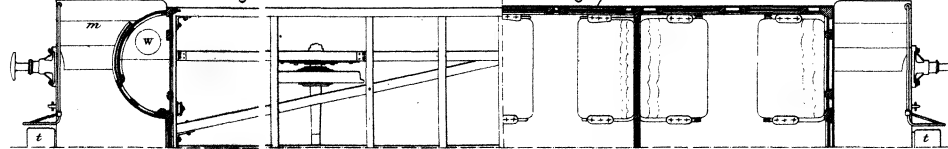


Fig. 16.

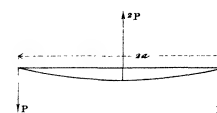


Fig. 17.

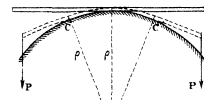


Fig. 18.

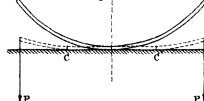


Fig. 10.  
Section of the 3<sup>rd</sup> class  
Compartment

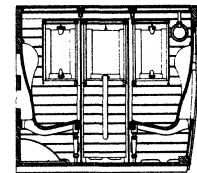
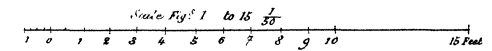
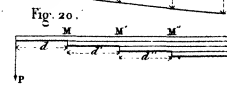
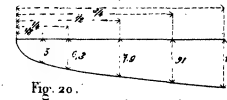


Fig. 19.  
Step case





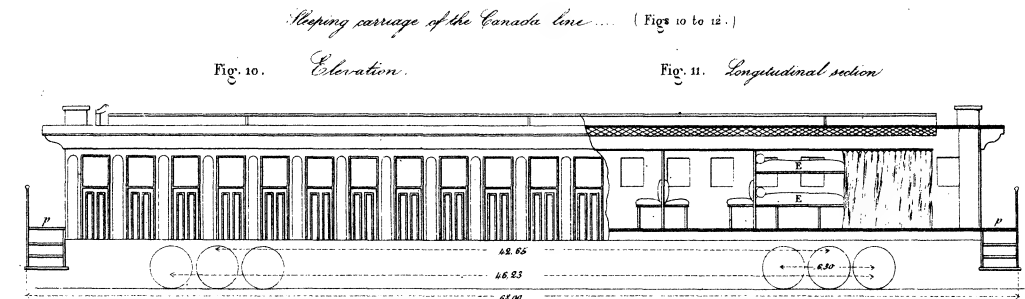
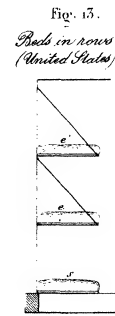
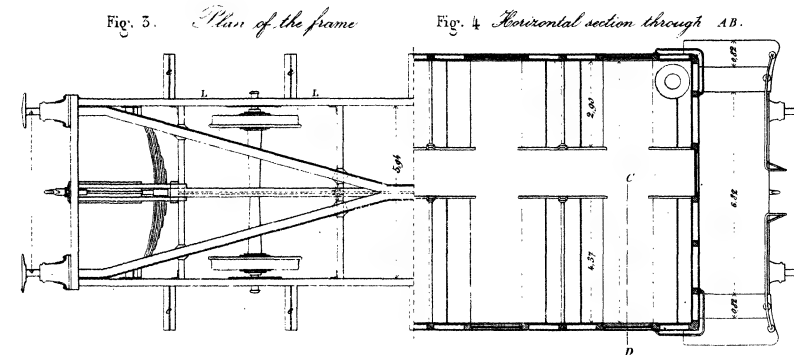
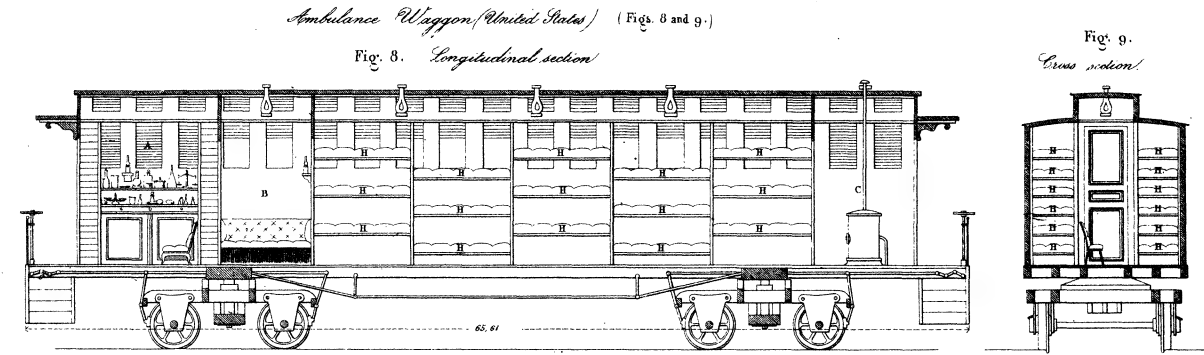
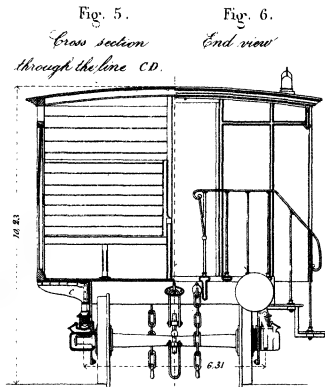
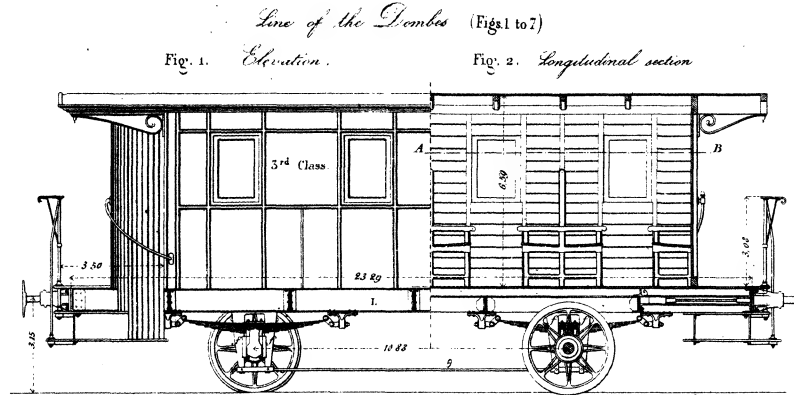
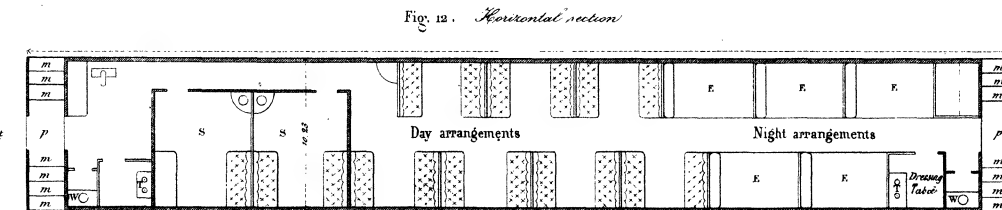
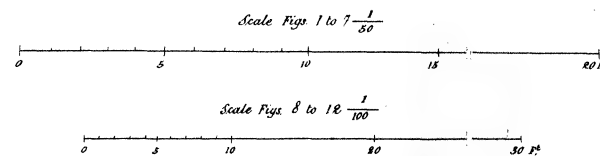
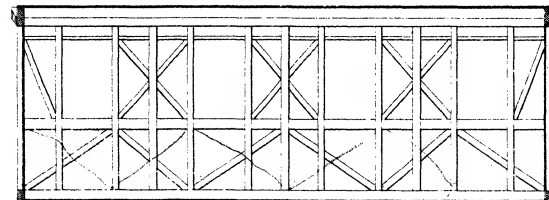
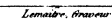


Fig. 7. *Skeleton of the body.*

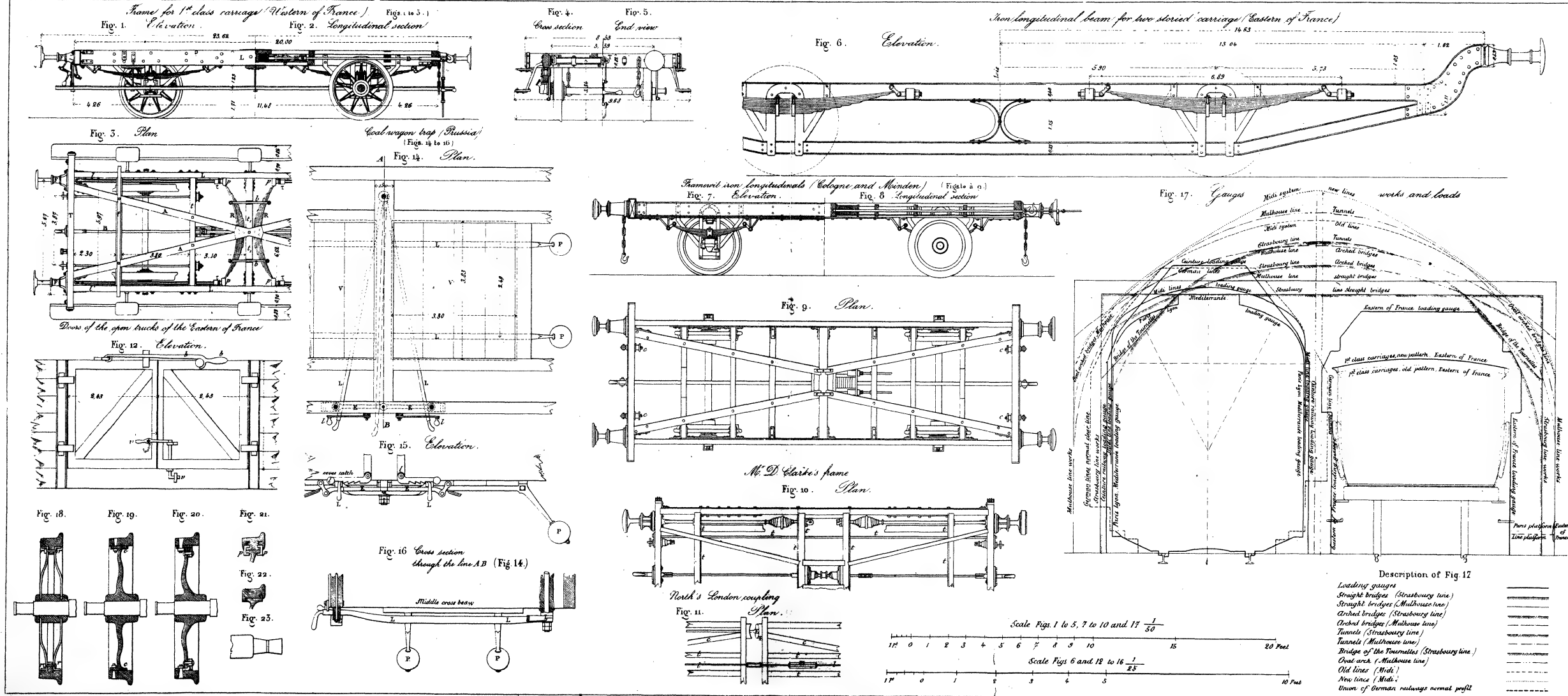




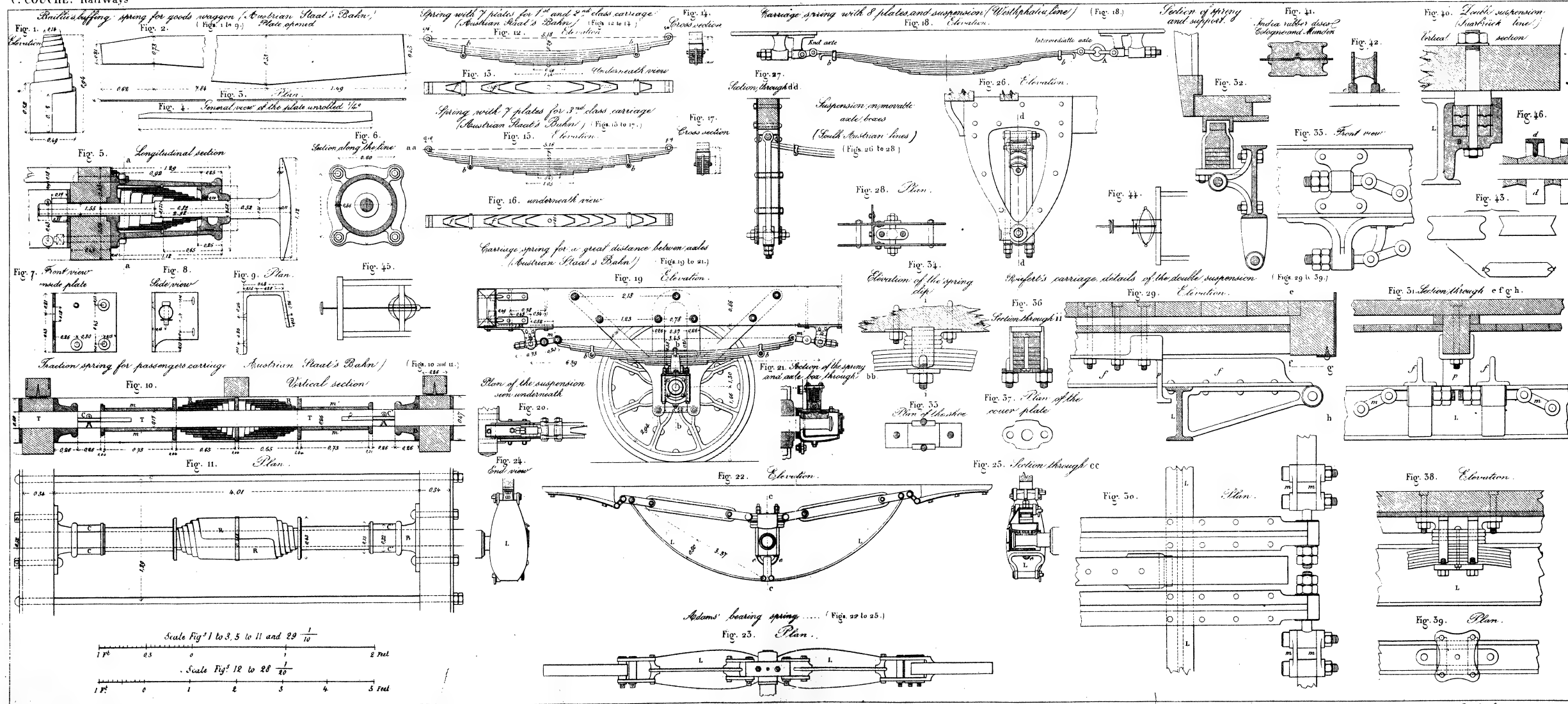




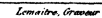




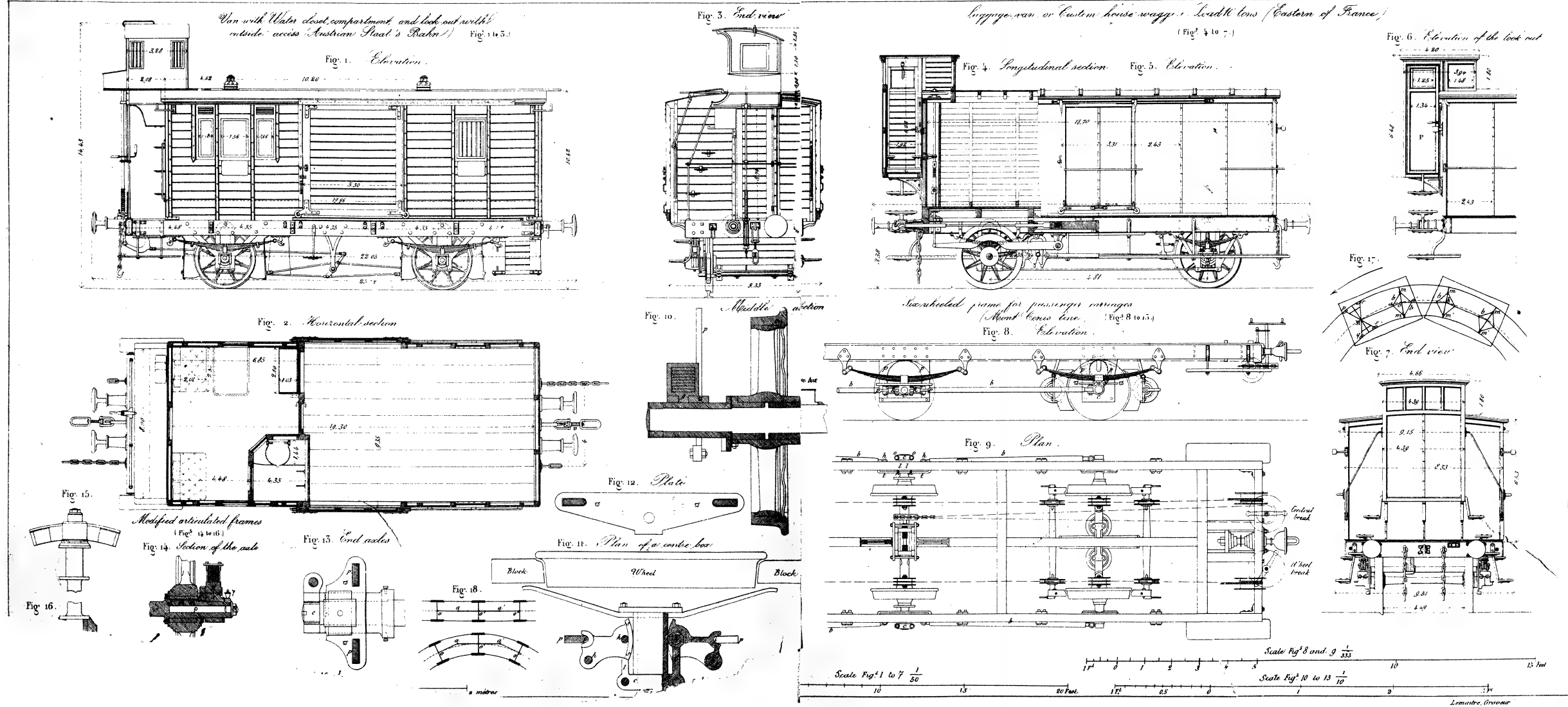






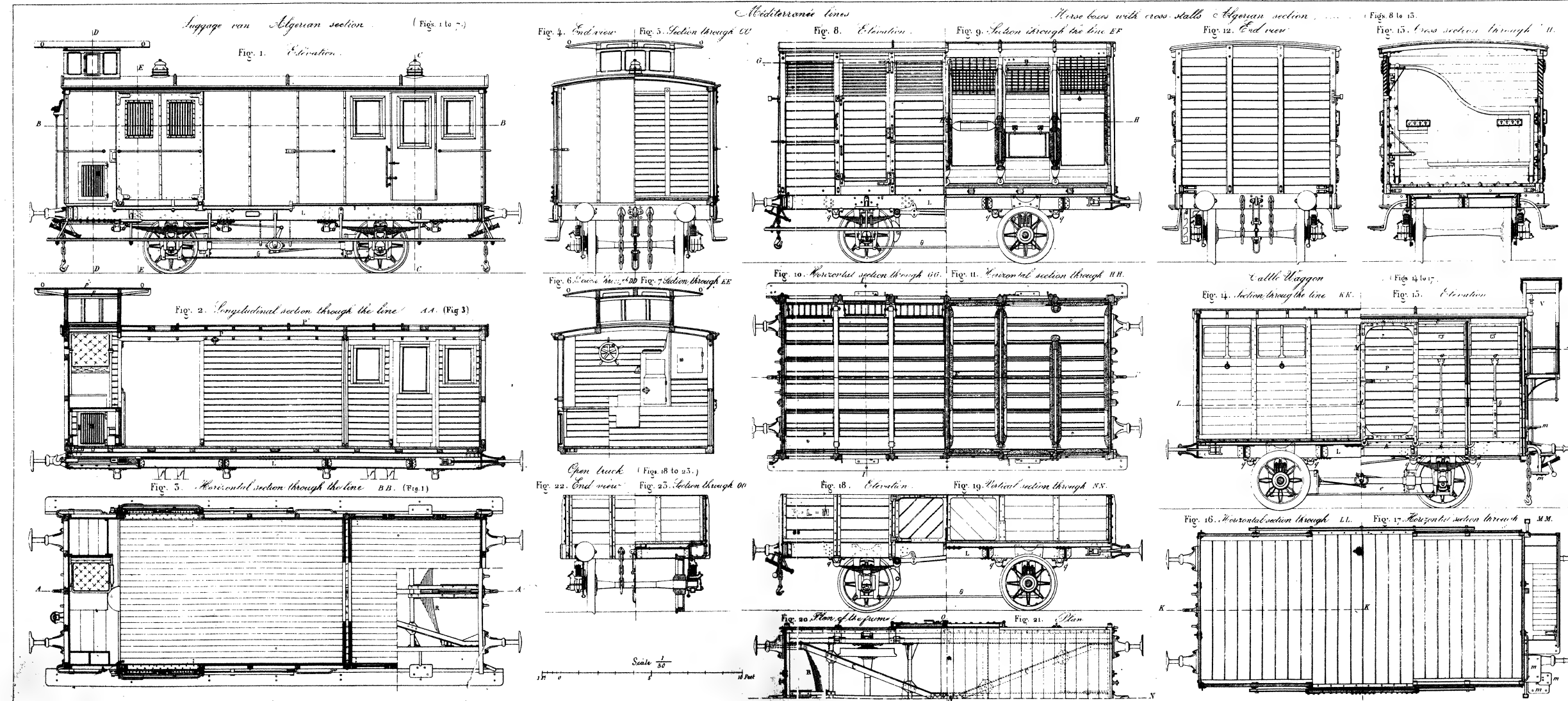














Wagon for the carriage of beer from Vienna to Paris  
(Figs. 1 to 3.)

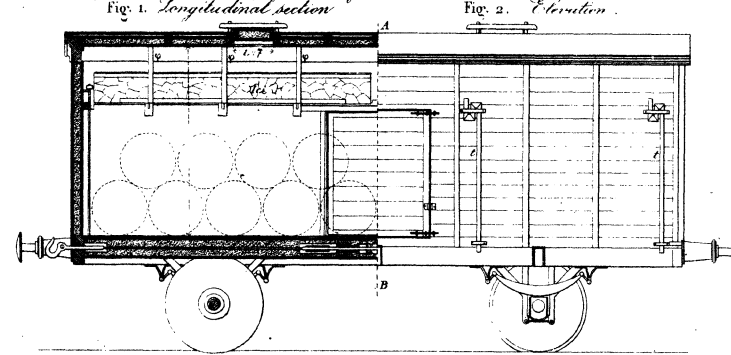


Fig. 3.  
Cross section through the line AB.

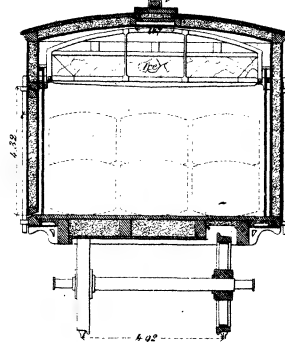


Fig. 4.  
End view

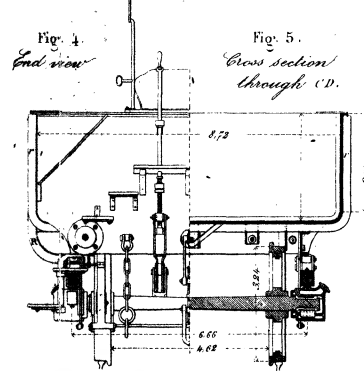


Fig. 5.  
Cross section through CD.

Open truck and coal wagon constructed entirely in wrought iron by M. M. Schmidt and Co at Breslau  
for the line from Vienna to Warsaw (Figs. 4 to 8.)

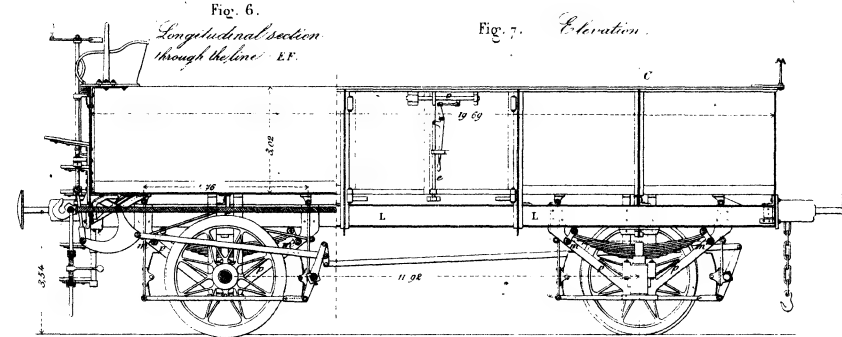
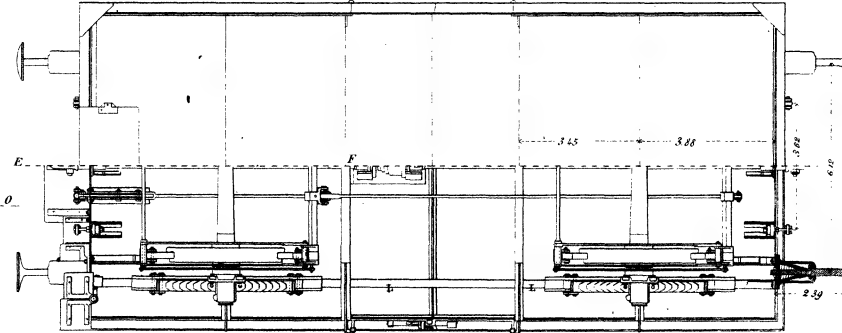


Fig. 7. Elevation

Fig. 8. Half plan of the body and of the frame



Close wagon in sheet iron Belgian railways (Figs. 9 to 14.)

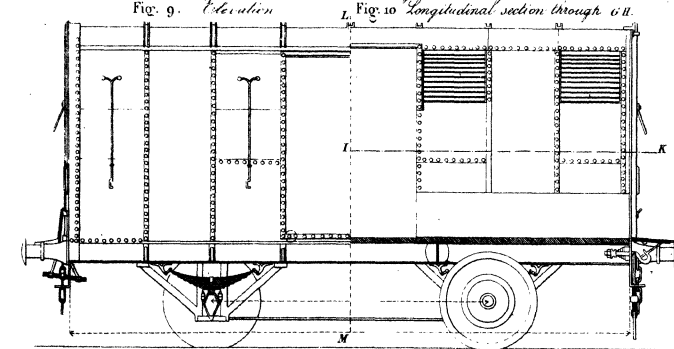


Fig. 10. Longitudinal section through GH.

Fig. 11. Cross section through IJ.

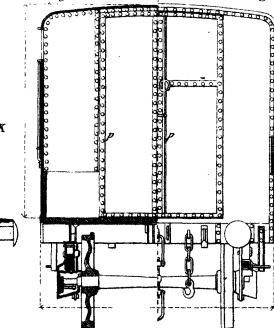


Fig. 12. End view

Wagon for planks narrow-gauge lines of Norway  
(Figs. 15 to 20.)

Fig. 15. Plan

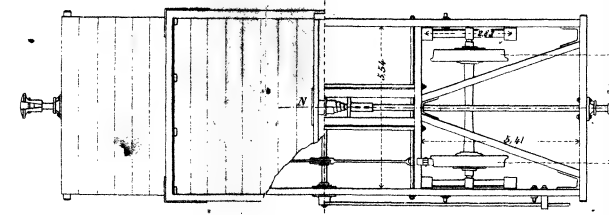


Fig. 16. Plan of the frame

Fig. 17. Elevation

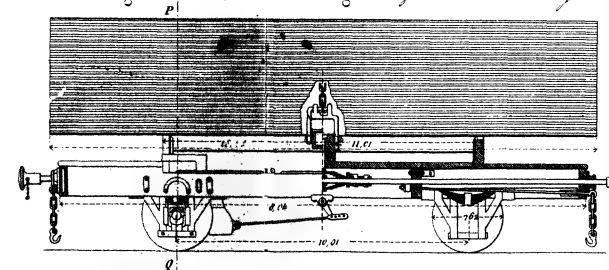


Fig. 18. Longitudinal section through NO.

Fig. 19. Elevation

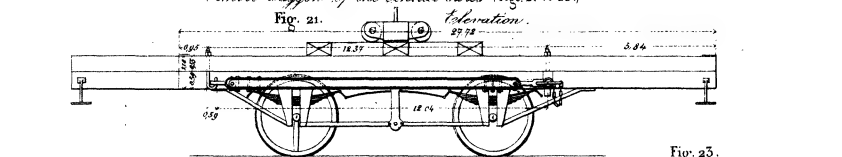


Fig. 20. Elevation

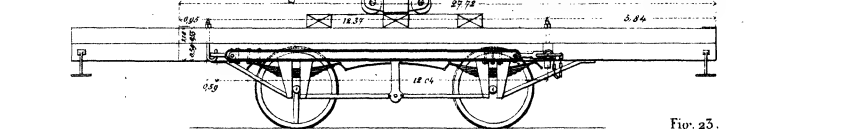


Fig. 21. Plan of the bar

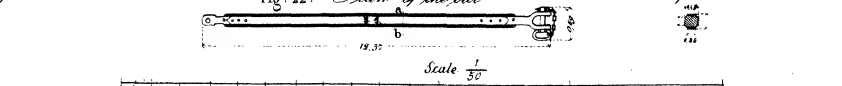


Fig. 22. Elevation

Fig. 23. Elevation

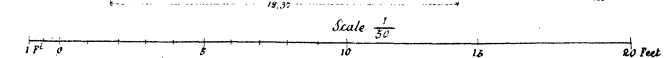


Fig. 23. Elevation

Fig. 24. Elevation

Fig. 25. Elevation

Fig. 26. Elevation

Fig. 27. Elevation

Fig. 28. Elevation

Fig. 29. Elevation

Fig. 30. Elevation

Fig. 31. Elevation

Fig. 32. Elevation

Fig. 33. Elevation

Fig. 34. Elevation

Fig. 35. Elevation

Fig. 36. Elevation

Fig. 37. Elevation

Fig. 38. Elevation

Fig. 39. Elevation

Fig. 40. Elevation

Fig. 41. Elevation

Fig. 42. Elevation

Fig. 43. Elevation

Fig. 44. Elevation

Fig. 45. Elevation

Fig. 46. Elevation

Fig. 47. Elevation

Fig. 48. Elevation

Fig. 49. Elevation

Fig. 50. Elevation

Fig. 51. Elevation

Fig. 52. Elevation

Fig. 53. Elevation

Fig. 54. Elevation

Fig. 55. Elevation

Fig. 56. Elevation

Fig. 57. Elevation

Fig. 58. Elevation

Fig. 59. Elevation

Fig. 60. Elevation

Fig. 61. Elevation

Fig. 62. Elevation

Fig. 63. Elevation

Fig. 64. Elevation

Fig. 65. Elevation

Fig. 66. Elevation

Fig. 67. Elevation

Fig. 68. Elevation

Fig. 69. Elevation

Fig. 70. Elevation

Fig. 71. Elevation

Fig. 72. Elevation

Fig. 73. Elevation

Fig. 74. Elevation

Fig. 75. Elevation

Fig. 76. Elevation

Fig. 77. Elevation

Fig. 78. Elevation

Fig. 79. Elevation

Fig. 80. Elevation

Fig. 81. Elevation

Fig. 82. Elevation

Fig. 83. Elevation

Fig. 84. Elevation

Fig. 85. Elevation

Fig. 86. Elevation

Fig. 87. Elevation

Fig. 88. Elevation

Fig. 89. Elevation

Fig. 90. Elevation

Fig. 91. Elevation

Fig. 92. Elevation

Fig. 93. Elevation

Fig. 94. Elevation

Fig. 95. Elevation

Fig. 96. Elevation

Fig. 97. Elevation

Fig. 98. Elevation

Fig. 99. Elevation

Fig. 100. Elevation

Fig. 101. Elevation

Fig. 102. Elevation

Fig. 103. Elevation

Fig. 104. Elevation

Fig. 105. Elevation

Fig. 106. Elevation

Fig. 107. Elevation

Fig. 108. Elevation

Fig. 109. Elevation

Fig. 110. Elevation

Fig. 111. Elevation

Fig. 112. Elevation

Fig. 113. Elevation

Fig. 114. Elevation

Fig. 115. Elevation

Fig. 116. Elevation

Fig. 117. Elevation

Fig. 118. Elevation

Fig. 119. Elevation

Fig. 120. Elevation

Fig. 121. Elevation

Fig. 122. Elevation

Fig. 123. Elevation

Fig. 124. Elevation

Fig. 125. Elevation

Fig. 126. Elevation

Fig. 127. Elevation

Fig. 128. Elevation

Fig. 129. Elevation

Fig. 130. Elevation

Fig. 131. Elevation

Fig. 132. Elevation

Fig. 133. Elevation

Fig. 134. Elevation

Fig. 135. Elevation

Fig. 136. Elevation

Fig. 137. Elevation

Fig. 138. Elevation

Fig. 139. Elevation

Fig. 140. Elevation

Fig. 141. Elevation

Fig. 142. Elevation

Fig. 143. Elevation

Fig. 144. Elevation

Fig. 145. Elevation

Fig. 146. Elevation

Fig. 147. Elevation

Fig. 148. Elevation

Fig. 149. Elevation

Fig. 150. Elevation

Fig. 151. Elevation

Fig. 152. Elevation

Fig. 153. Elevation

Fig. 154. Elevation

Fig. 155. Elevation

Fig. 156. Elevation

Fig. 157. Elevation

Fig. 158. Elevation

Fig. 159. Elevation

Fig. 160. Elevation

Fig. 161. Elevation

Fig. 162. Elevation

Fig. 163. Elevation

Fig. 164. Elevation

Fig. 165. Elevation

Fig. 166. Elevation

Fig. 167. Elevation

Fig. 168. Elevation

Fig. 169. Elevation

Fig. 170. Elevation

Fig. 171. Elevation

Fig. 172. Elevation

Fig. 173. Elevation

Fig. 174. Elevation

Fig. 175. Elevation

Fig. 176. Elevation

Fig. 177. Elevation

Fig. 178. Elevation

Fig. 179. Elevation

Fig. 180. Elevation

Fig. 181. Elevation

Fig. 182. Elevation

Fig. 183. Elevation

Fig. 184. Elevation

Fig. 185. Elevation

Fig. 186. Elevation

Fig. 187. Elevation

Fig. 188. Elevation

Fig. 189. Elevation

Fig. 190. Elevation

Fig. 191. Elevation

Fig. 192. Elevation

Fig. 193. Elevation

Fig. 194. Elevation

Fig. 195. Elevation

Fig. 196. Elevation

Fig. 197. Elevation

Fig. 198. Elevation

Fig. 199. Elevation

Fig. 200. Elevation

Fig. 201. Elevation

Fig. 202. Elevation

Fig. 203. Elevation

Fig. 204. Elevation

Fig. 205. Elevation

Fig. 206. Elevation

Fig. 207. Elevation

Fig. 208. Elevation

Fig. 209. Elevation

Fig. 210. Elevation

Fig. 211. Elevation

Fig. 212. Elevation

Fig. 213. Elevation

Fig. 214. Elevation

Fig. 215. Elevation

Fig. 216. Elevation

Fig. 217. Elevation

Fig. 218. Elevation

Fig. 219. Elevation

Fig. 220. Elevation

Fig. 221. Elevation

Fig. 222. Elevation

Fig. 223. Elevation

Fig. 224. Elevation

Fig. 225. Elevation

Fig. 226. Elevation

Fig. 227. Elevation

Fig. 228. Elevation

Fig. 229. Elevation

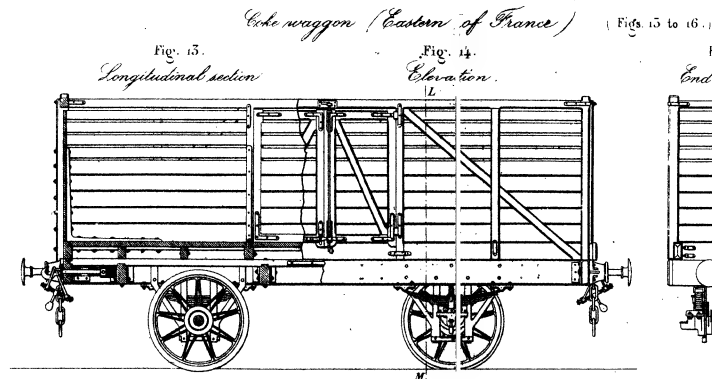
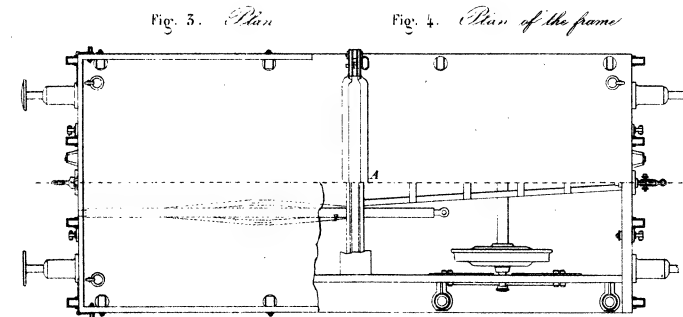
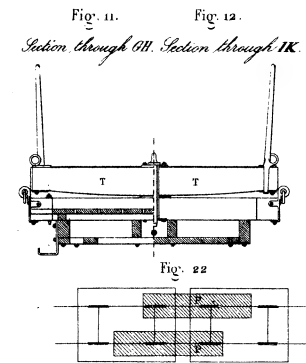
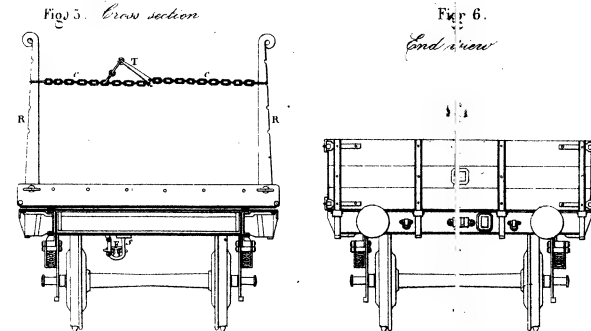
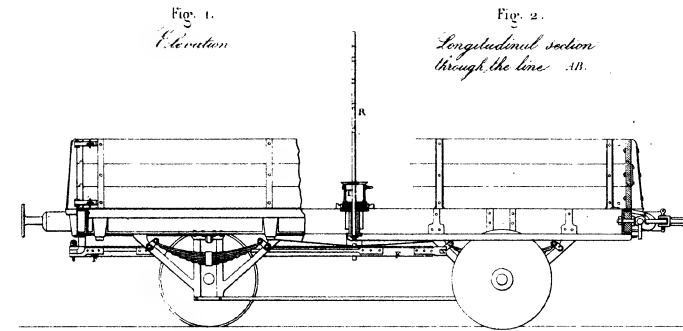
Fig. 230. Elevation



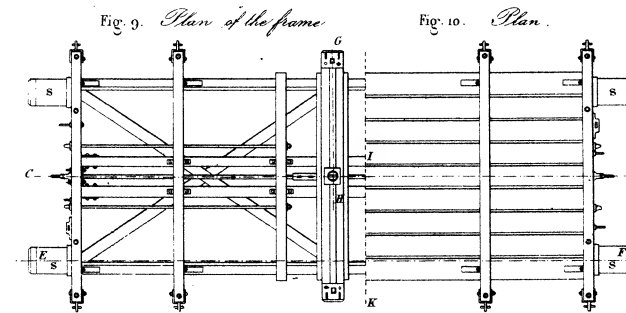
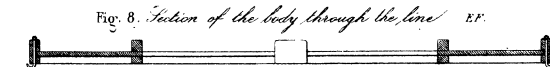
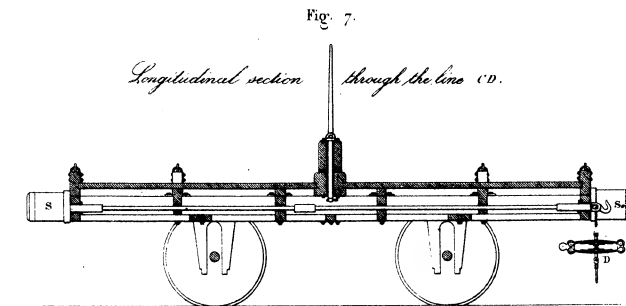




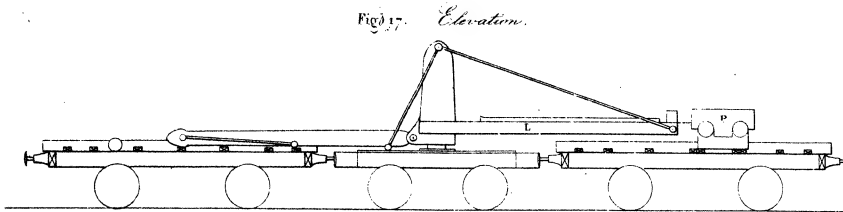
*Platform wagon with iron frame, applicable to the carriage of timber (Upper Silesia) (Figs. 1 to 6.)*



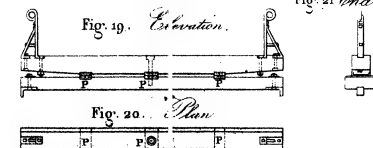
*Wagon for the carriage of timber (Eastern of France) (Figs. 7 to 12.)*



*Travelling crane of 7 tons (Paris and Mediterranean lines)*



*Wagon for the carriage of timber (Central Swiss) (Figs. 19 to 21.)*

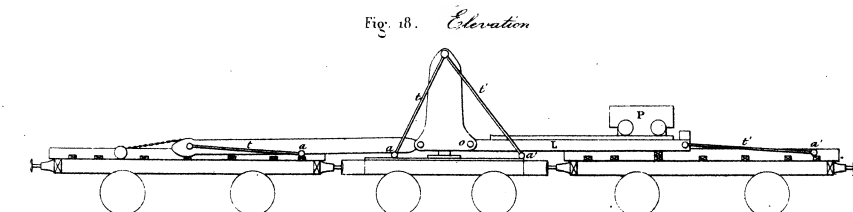


Scale Figs 1 to 16 and 19 to 21  $\frac{1}{50}$

Scale Fig. 17 and 18  $\frac{1}{100}$

10 ft 0 1 2 3 4 5 6 7 8 9 10 15 20 30 ft

*Travelling crane of 7 tons (Paris and Mediterranean lines)*



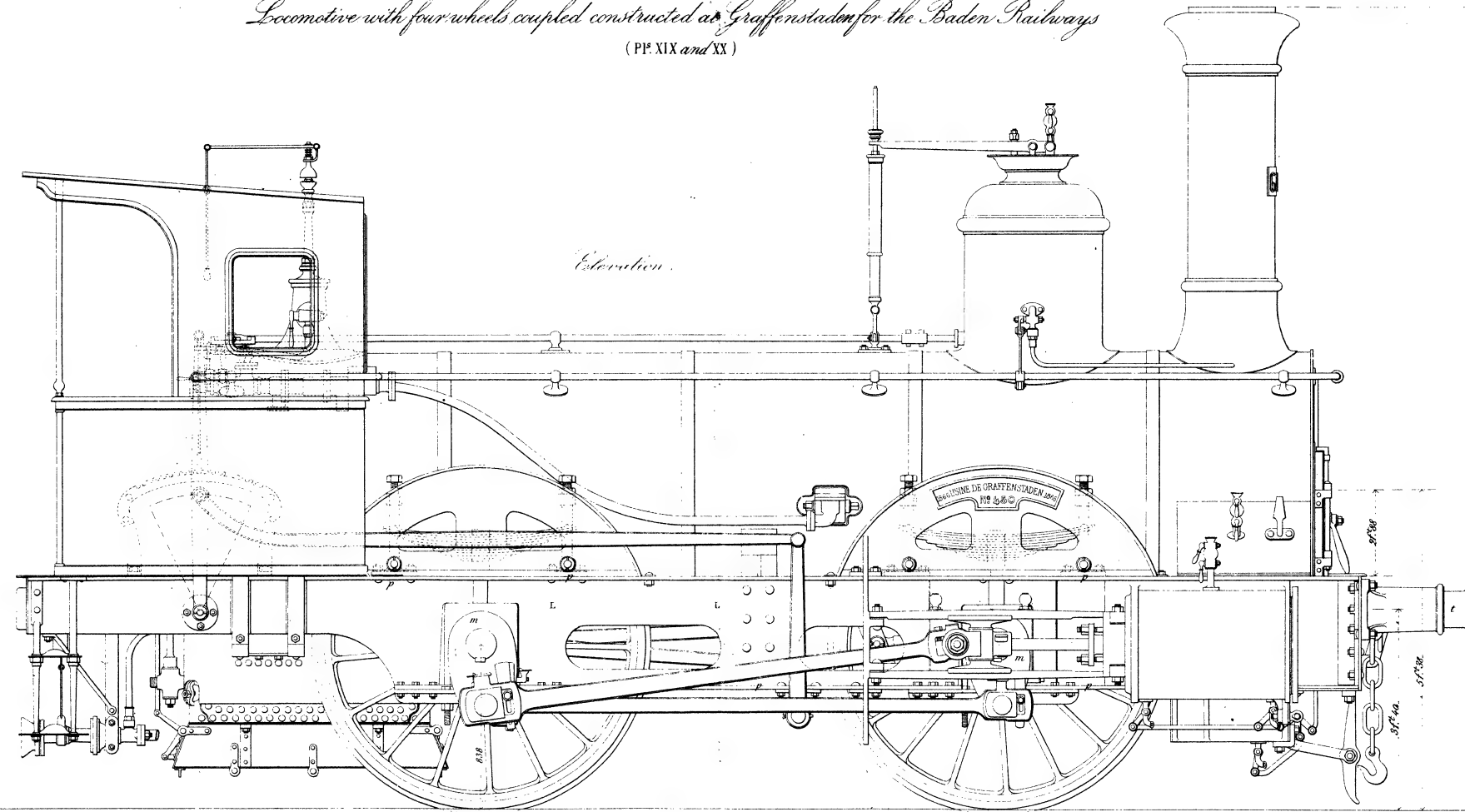








*Locomotive with four wheels coupled constructed at Graffenstaden for the Baden Railways*  
(Pl. XIX and XX)

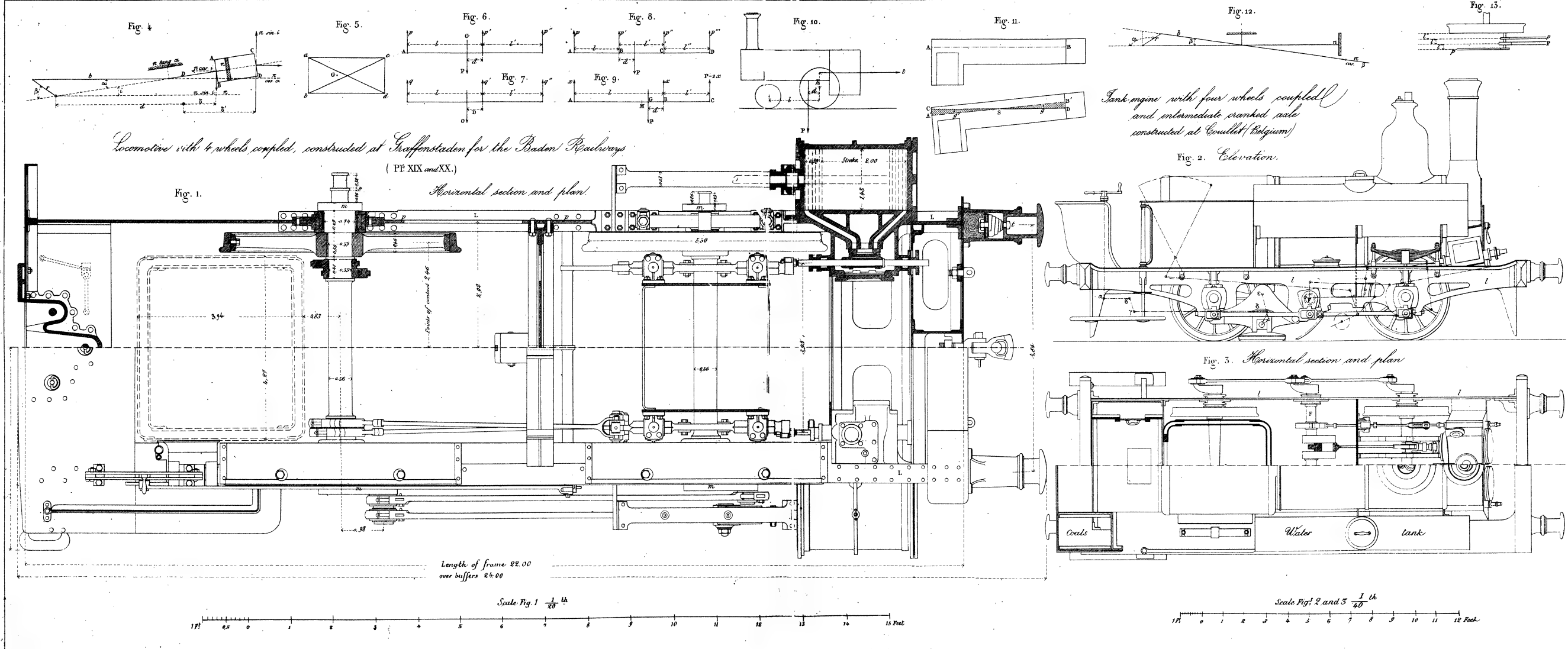


Scale 1/20<sup>th</sup>

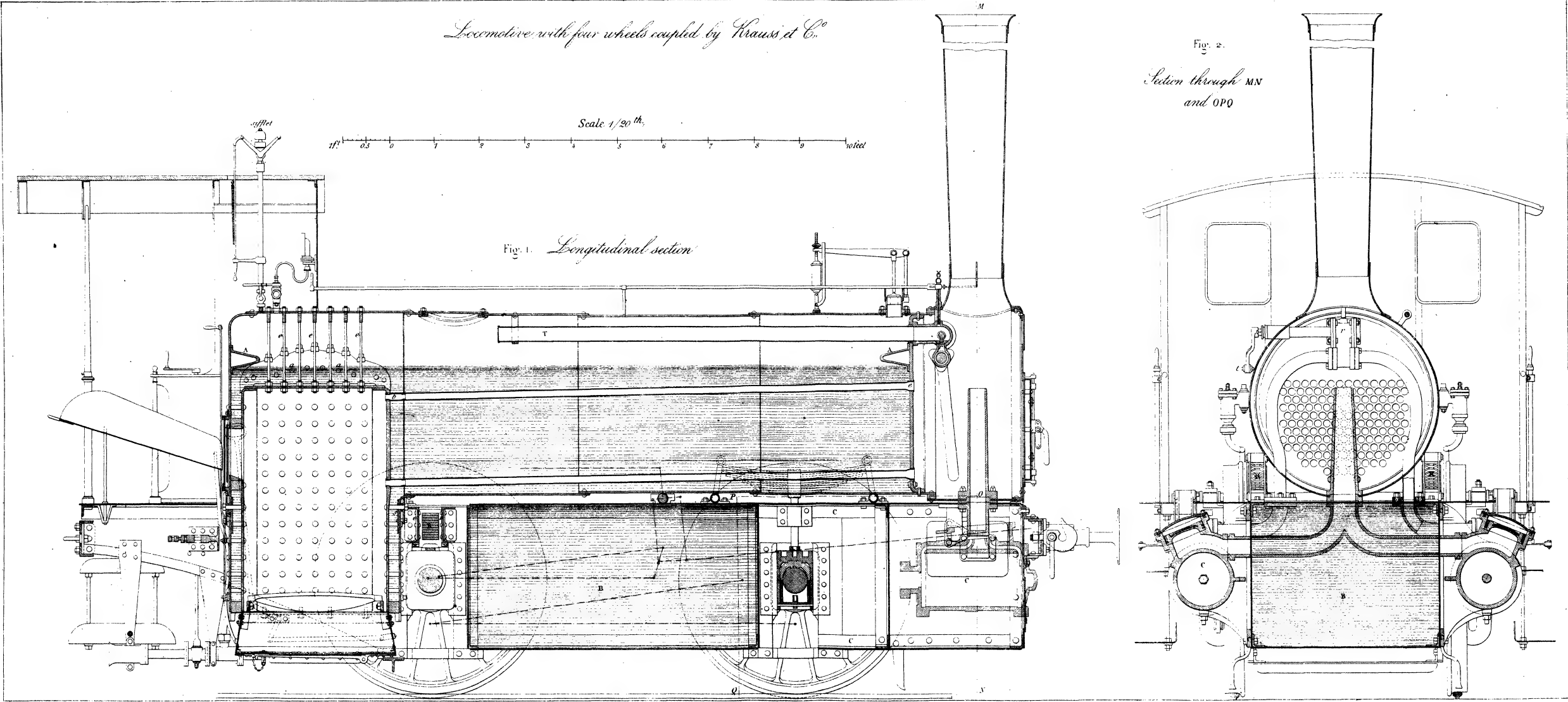
11<sup>ft</sup> 0.5 1 2 3 4 5 6 7 8 9 10 feet



# FOUR WHEELED COUPLED LOCOMOTIVES











*Express Locomotive with six wheels uncoupled, constructed at the Creusot works for the Great Eastern Ry (Pls XXII. and XXIII)*

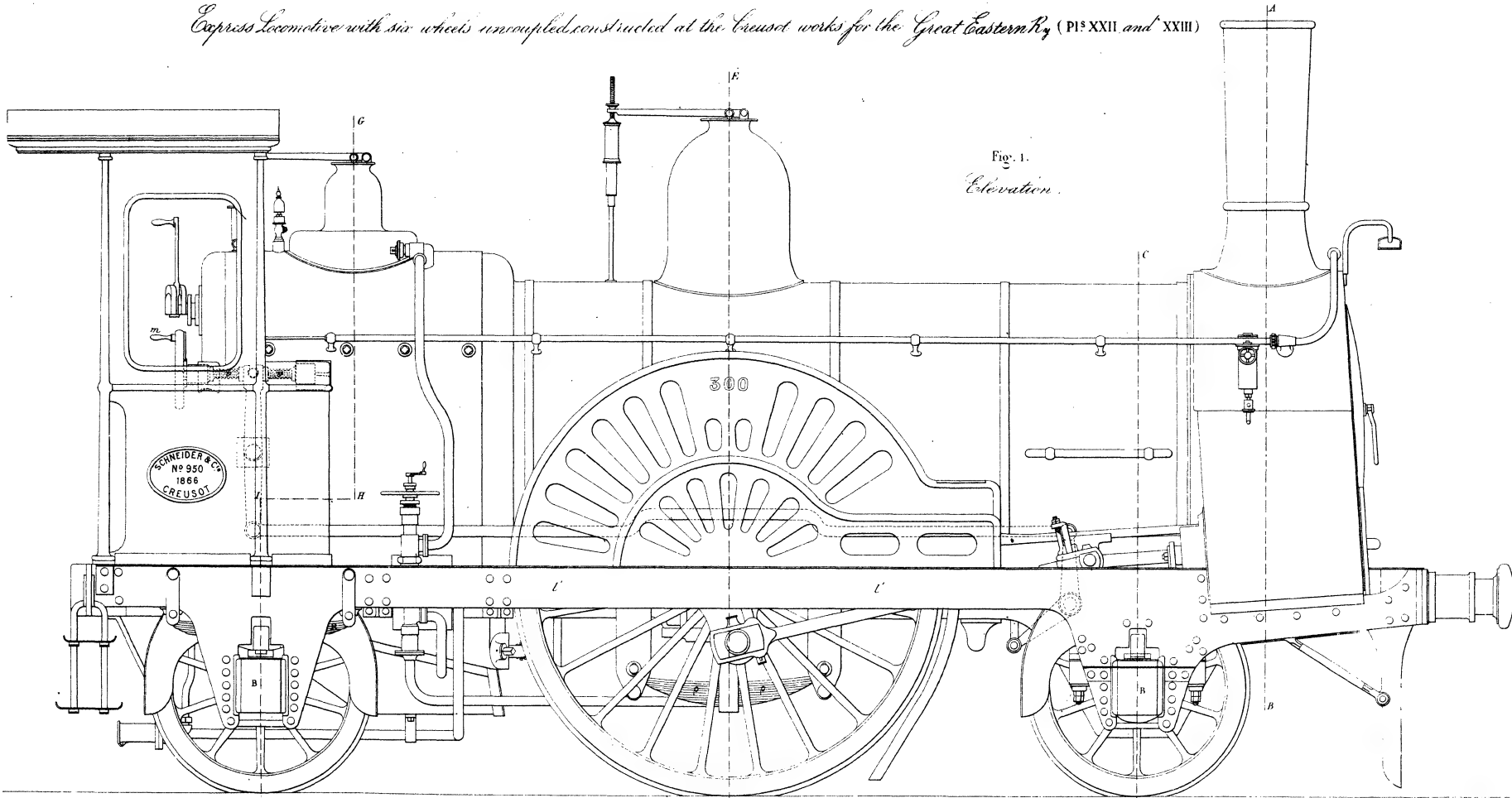


Fig. 1.  
Elevation.

Scale 1/20 th.  
11' 0.5 1 2 3 4 5 6 7 8 9 10 feet

Fig. 2.  
Section through AB

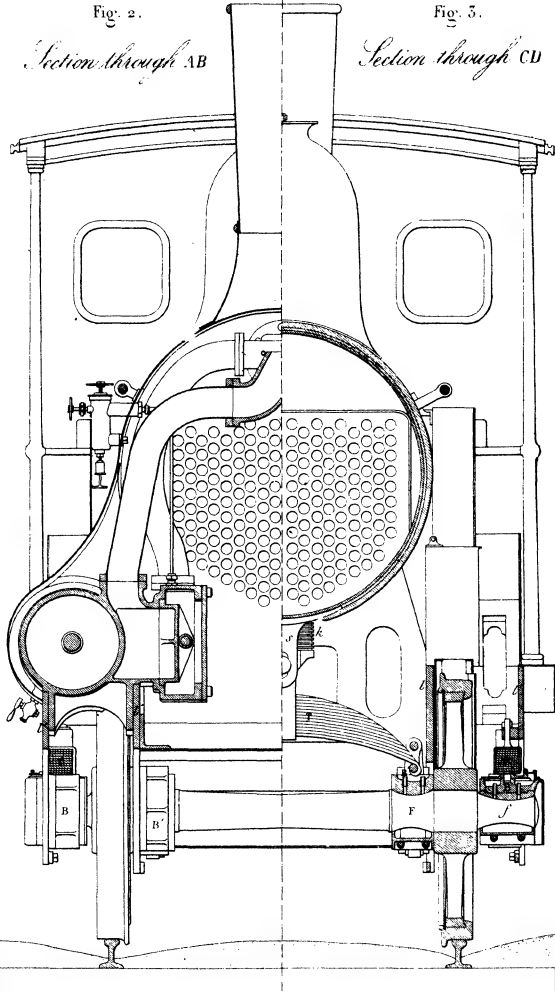
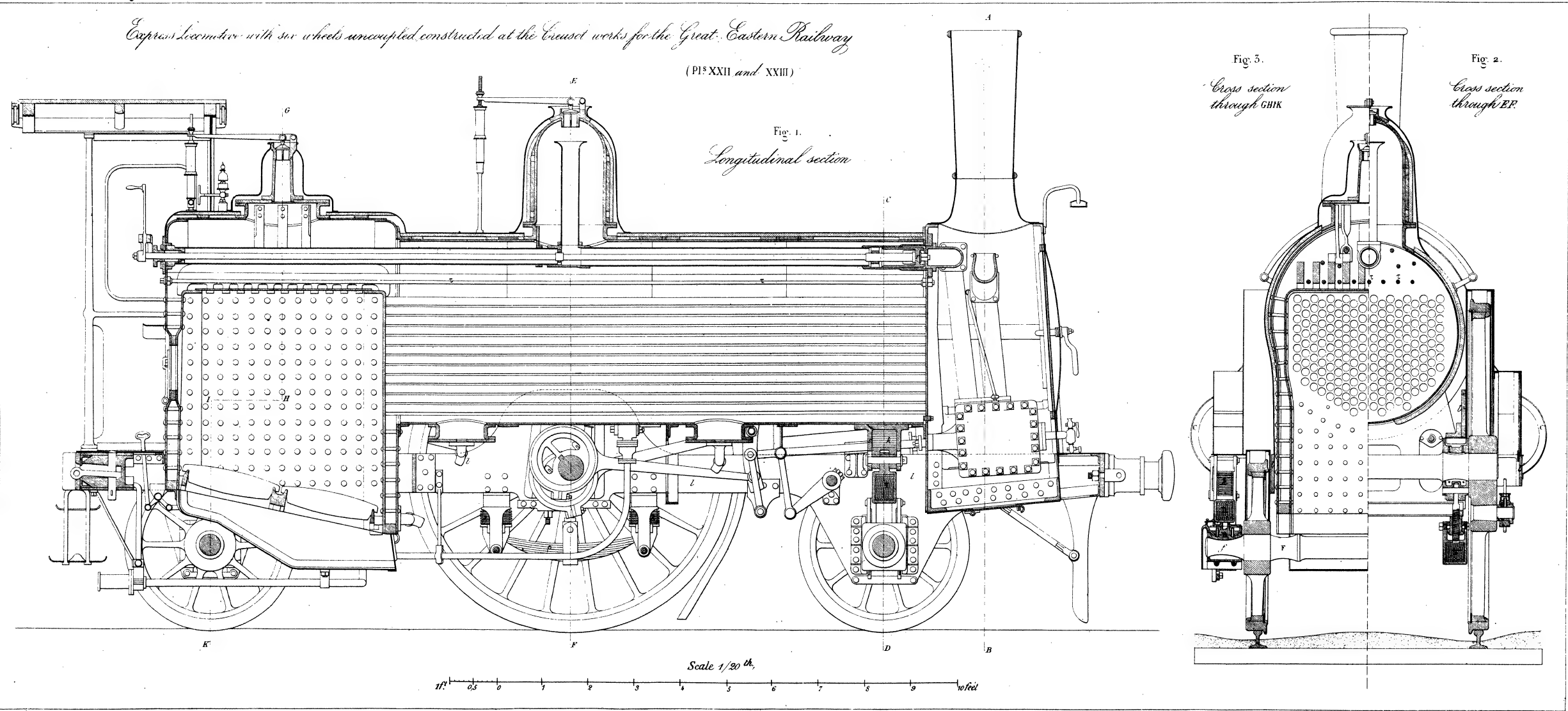


Fig. 3.  
Section through CD





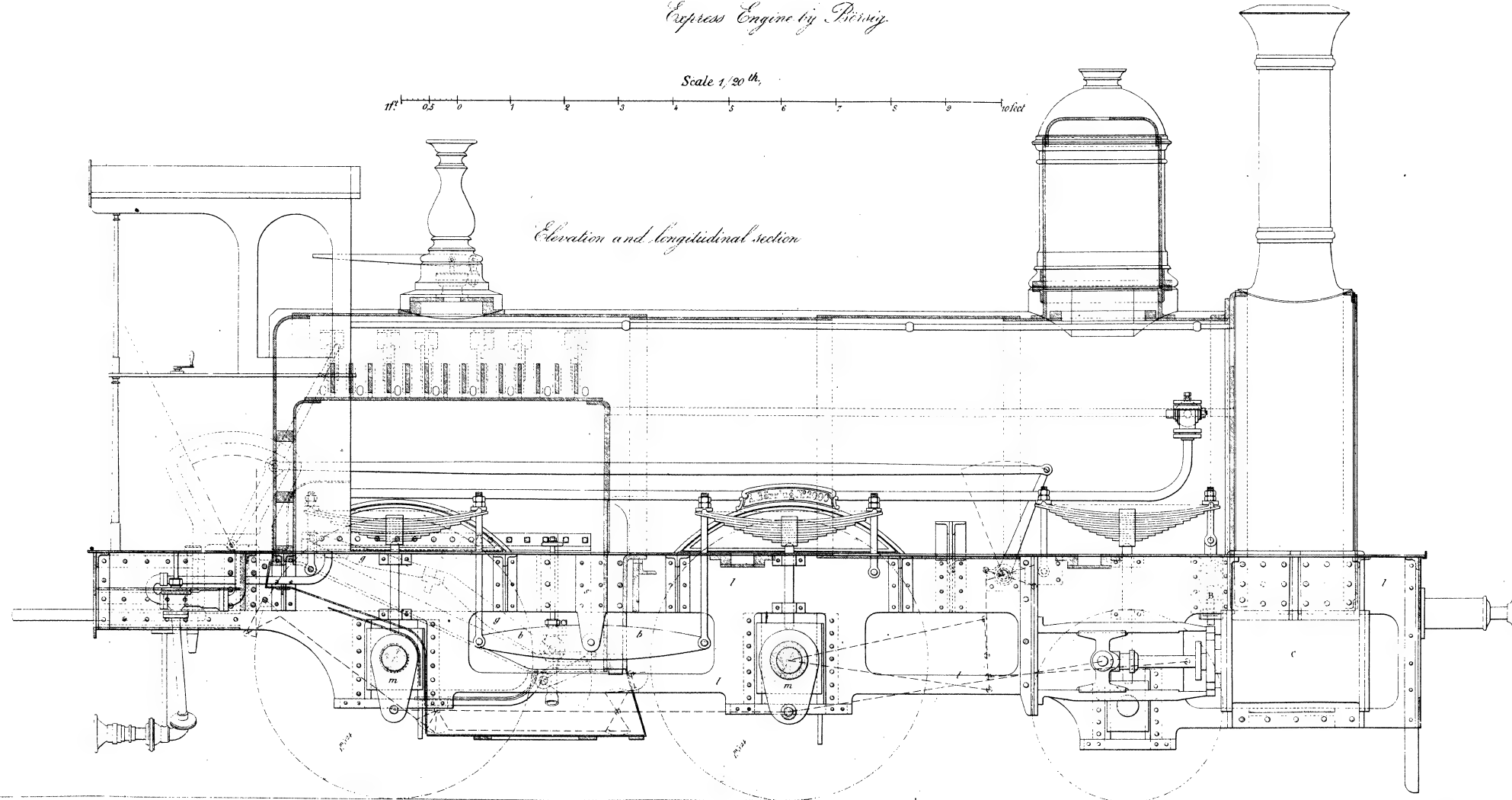


*Express Engine by Pernig.*

Scale  $1/20^{th}$ .

11' 0.5 0 1 2 3 4 5 6 7 8 9 10 feet

*Elevation and longitudinal section*



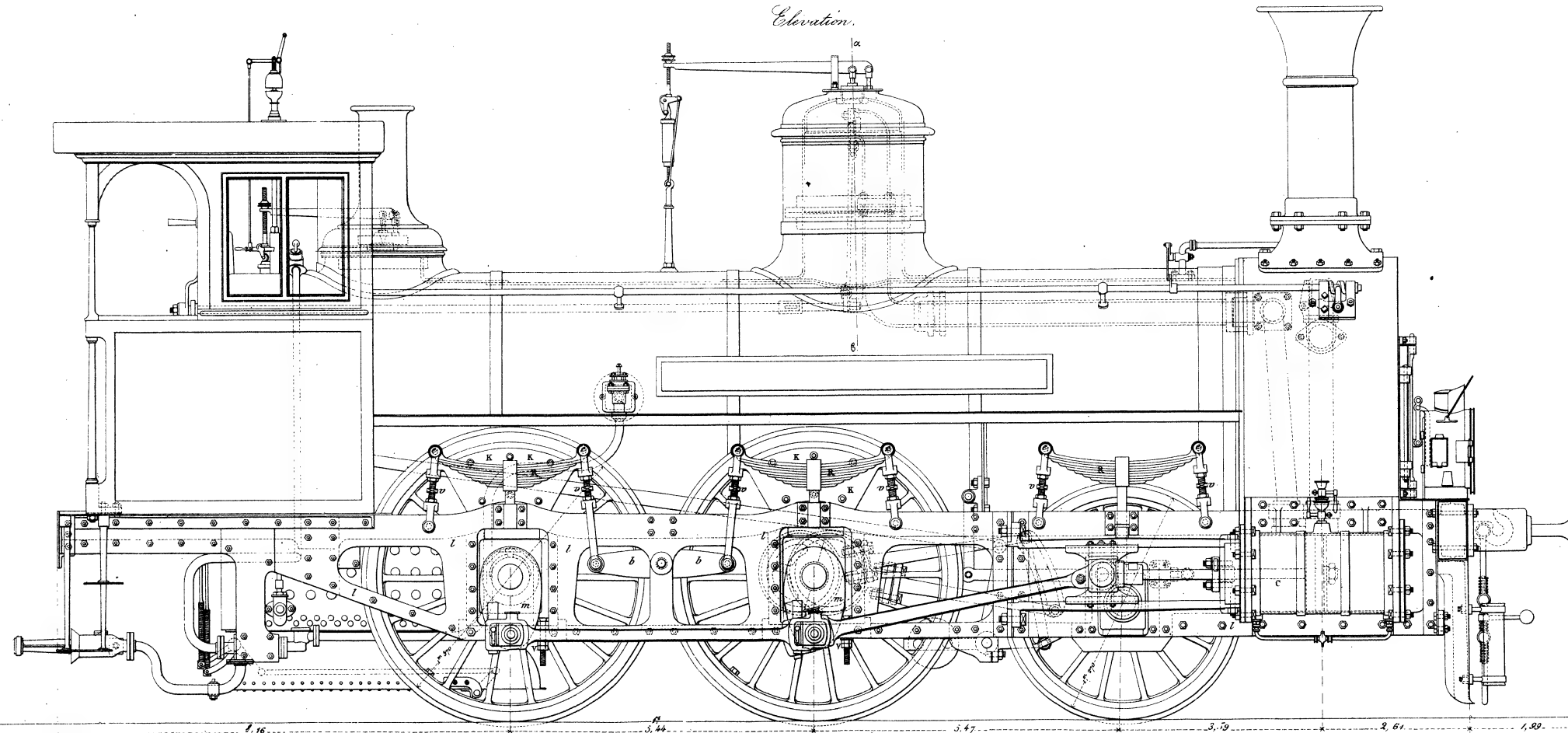


SIX WHEELED LOCOMOTIVES WITH FOUR COUPLED

*Engine. Line from Warsaw to Terespol constructed by Sigl. (Vienna.)*

(Pls XXV, XXVI and XXVII)

*Elevation.*



11' 0.5 0 1 2 3 4 5 6 7 8 9 10 feet  
 2.16 3.44 14.83 3.47 3.79 2.61 1.89  
 Scale 1/20<sup>th</sup>

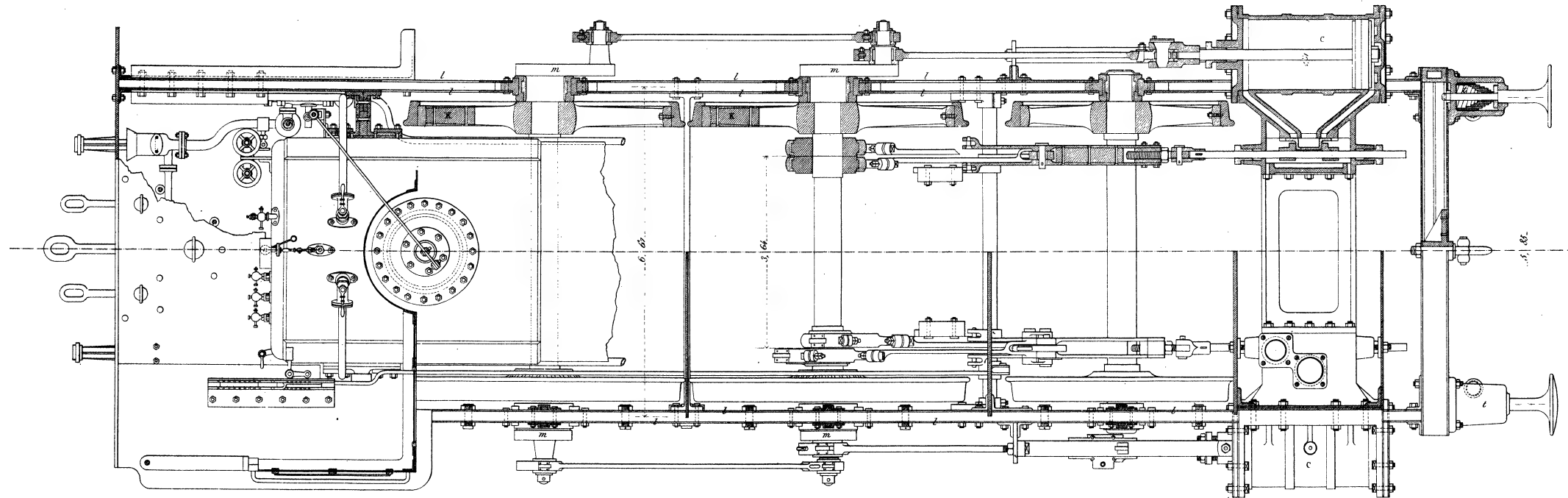




SIX WHEELED LOCOMOTIVES WITH FOUR COUPLED.

*Engine Line from Warsaw to Jersopol constructed by Sigl - Vienna*  
(Pls XXV, XXVI and XXVII)

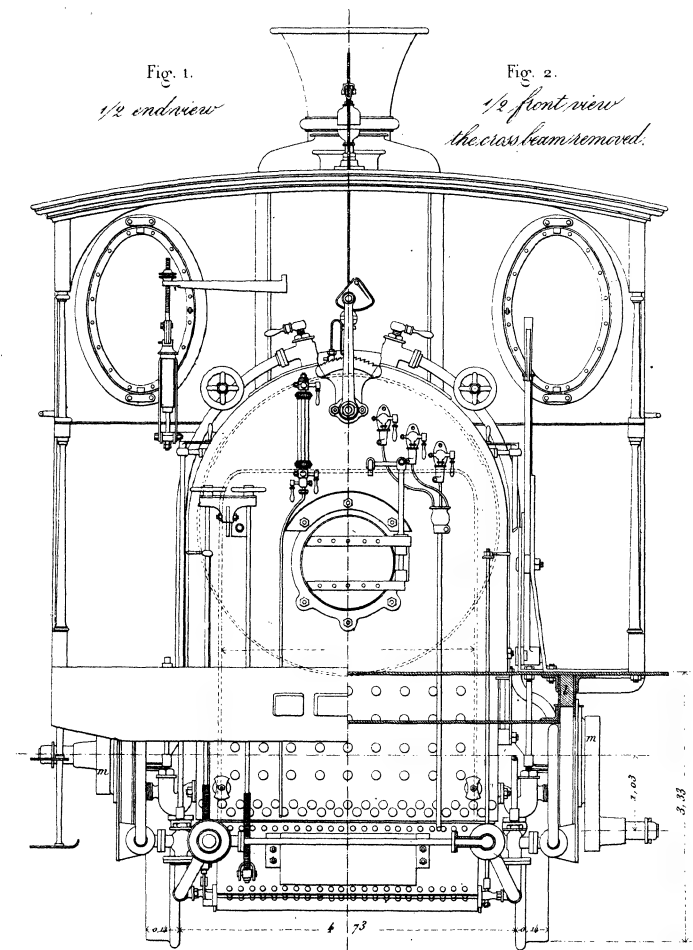
*Horizontal section and Plan*



Scale 1/20<sup>th</sup>

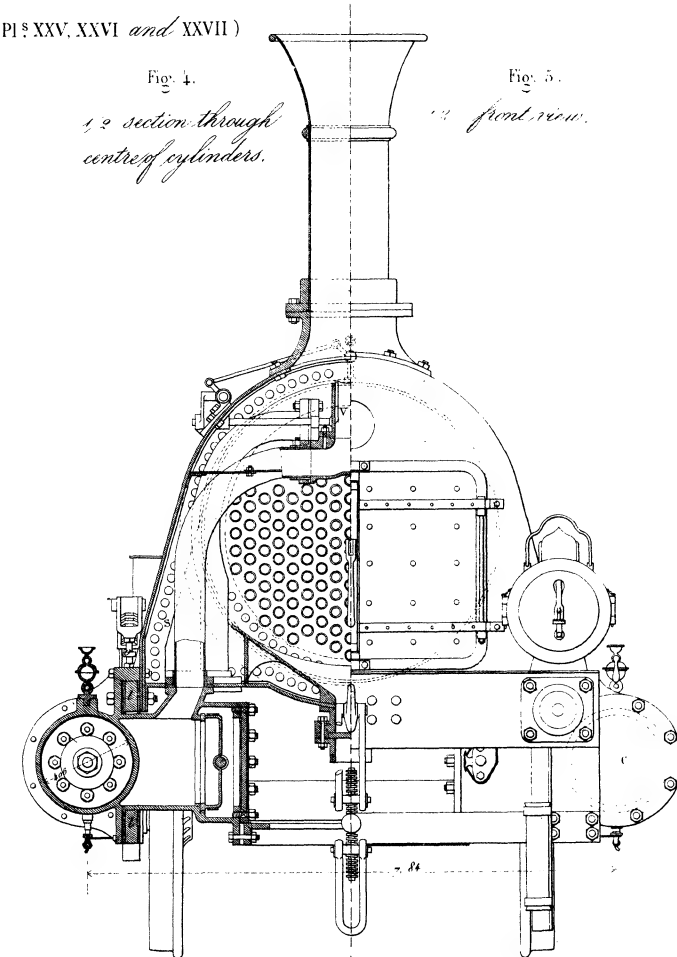
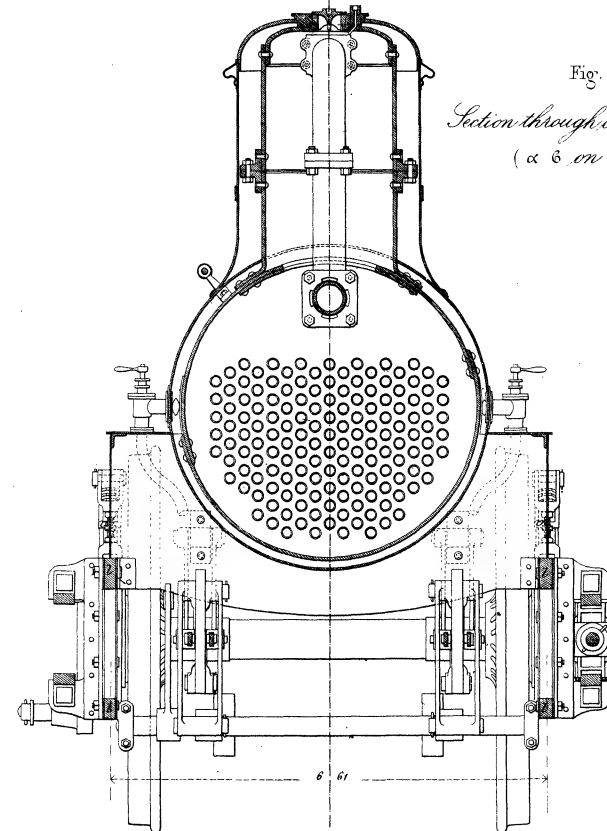
11' 0.5 0 1 2 3 4 5 6 7 8 9 10 feet





*Engine. Line from Warsaw to Terespol constructed by Sigl. Vienna (Pls XXV, XXVI and XXVII)*

*Gauge 4.99 from edge to edge of rails.*



Scale 1/20<sup>th</sup>.

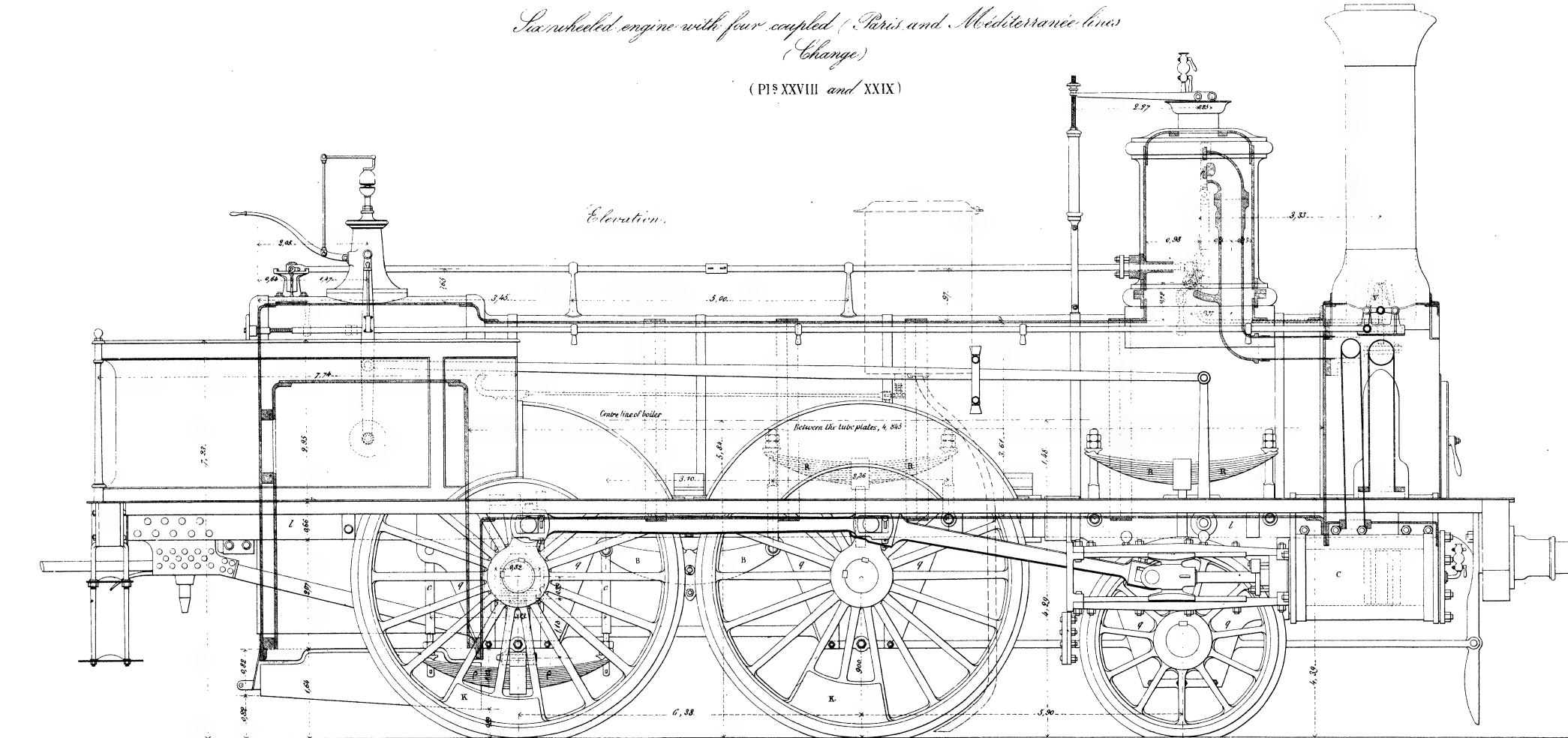
11' 0.5 0 1 2 3 4 5 6 7 8 9 10 feet



*Six wheeled engine with four coupled (Paris and Mediterranean lines  
(Change.)*

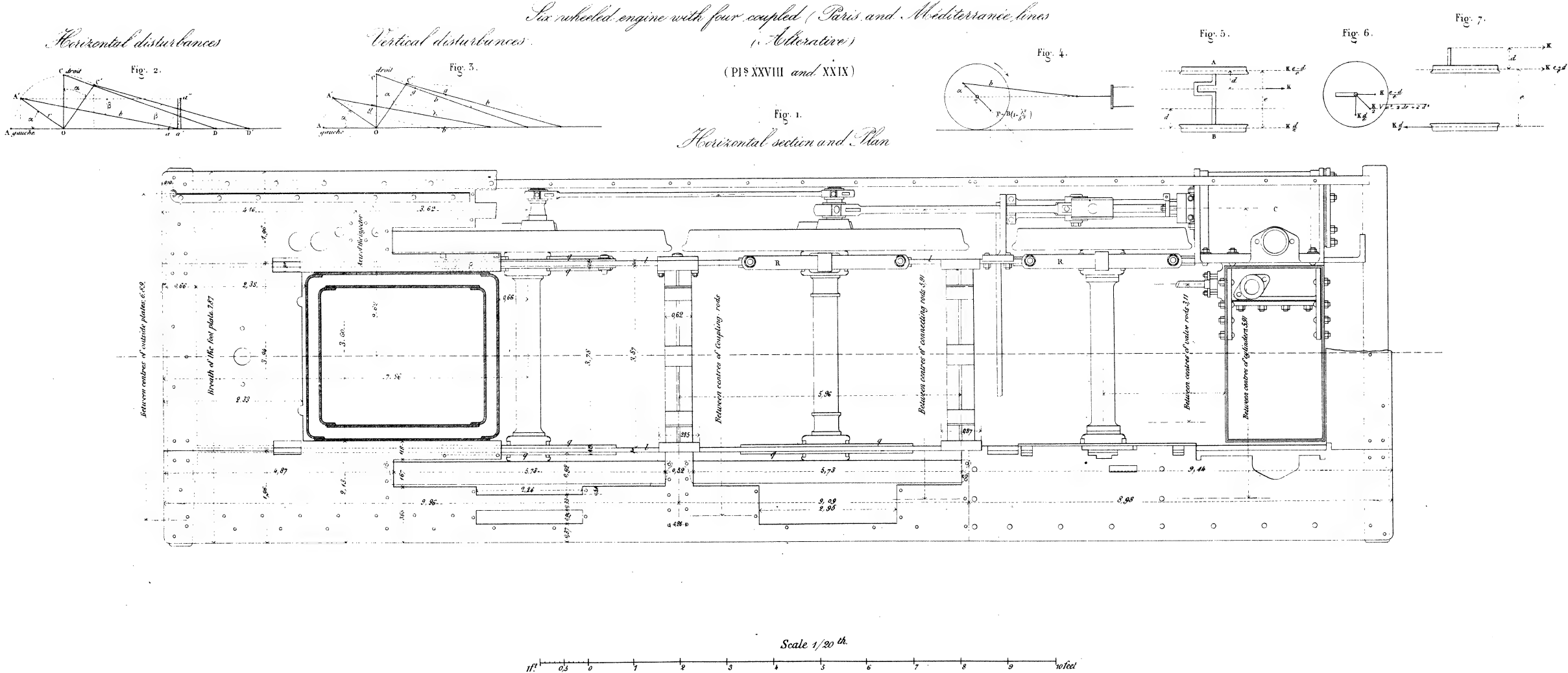
( P1§ XXVIII *and* XXIX )

Elevation.



Scale 1/20<sup>th</sup>.

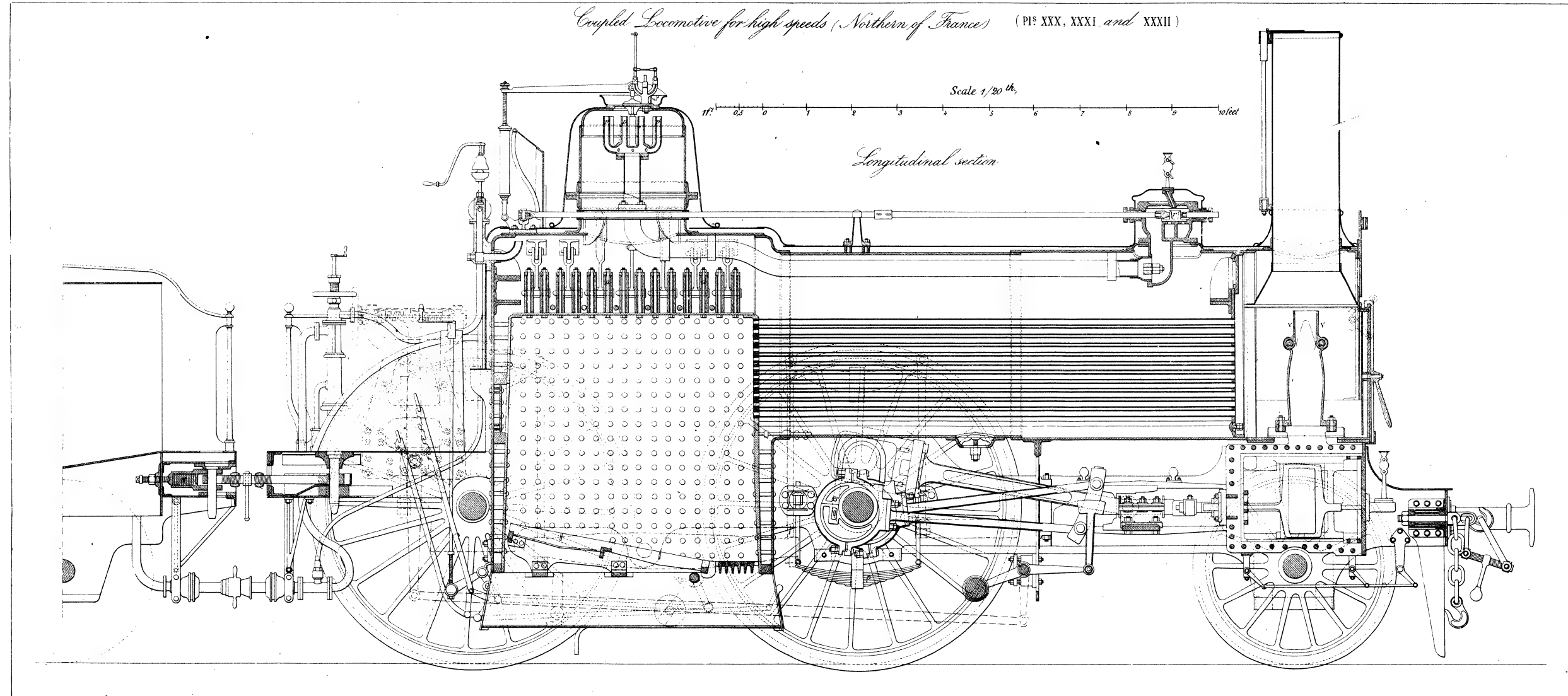








SIX WHEELED LOCOMOTIVES WITH FOUR COUPLED.

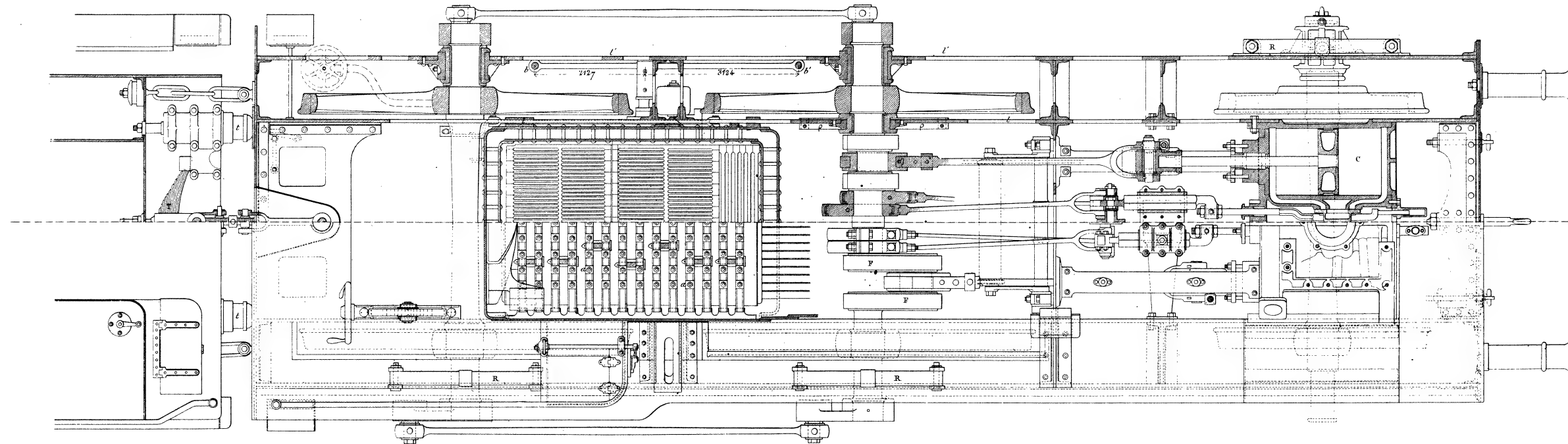




*Coupled Locomotive for high speeds (Northern of France)*

(Pls. XXX, XXXI and XXXII)

*Horizontal section and Plan*



Scale 1/20<sup>th</sup>.

11' 0.5 0 1 2 3 4 5 6 7 8 9 10 feet



*Coupled Locomotive for high speeds (Northern of France)*

(Pls XXX, XXXI, and XXXII.)

Scale  $\frac{1}{16}$ .

Fig. 1.  
*End view.*

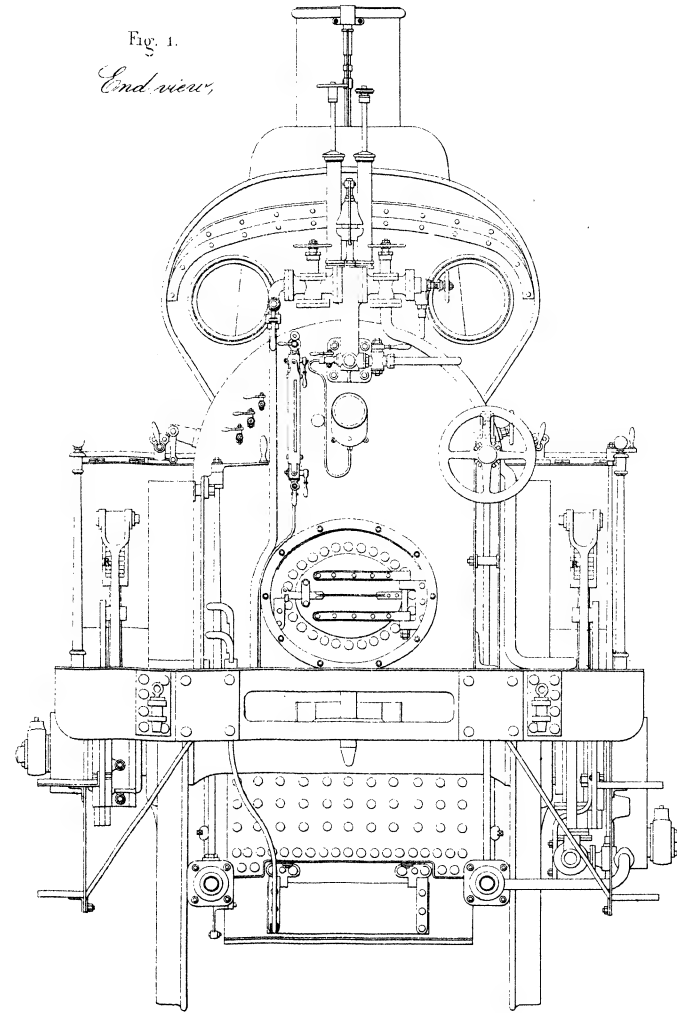


Fig. 2.  
*1/2 cross section  
through the fire-box*

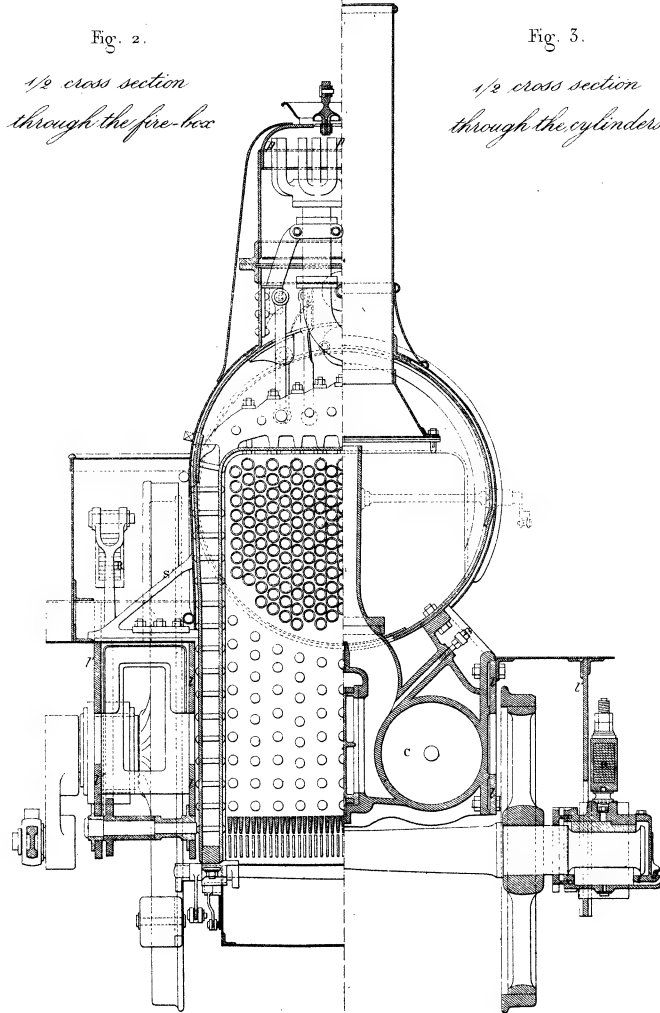


Fig. 3.  
*1/2 cross section  
through the cylinders*

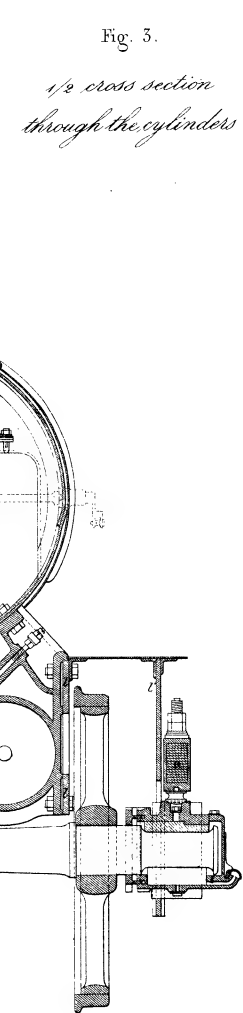


Fig. 4.  
*1/2 cross section  
through the driving wheel*

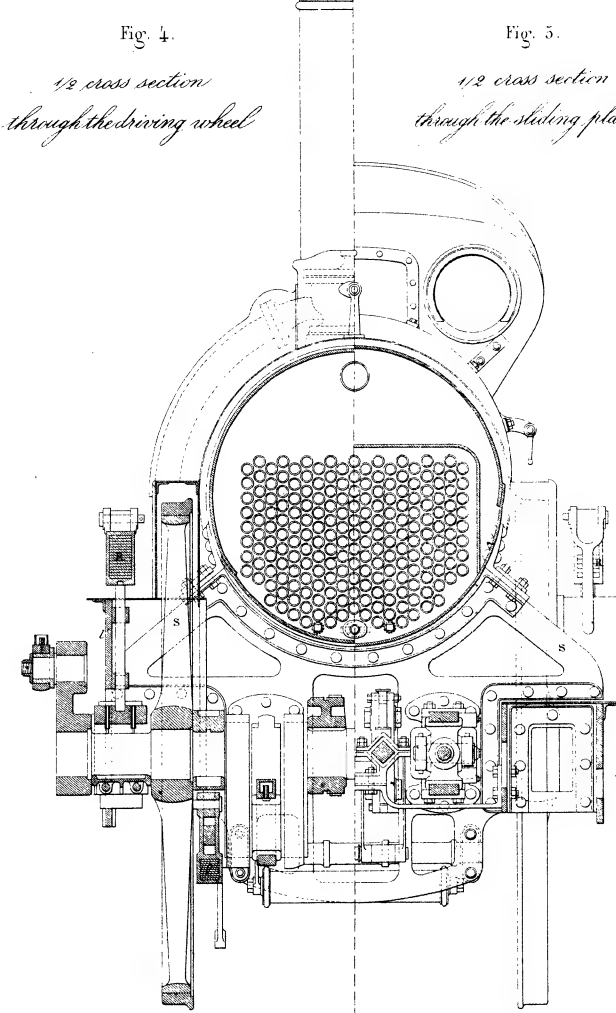
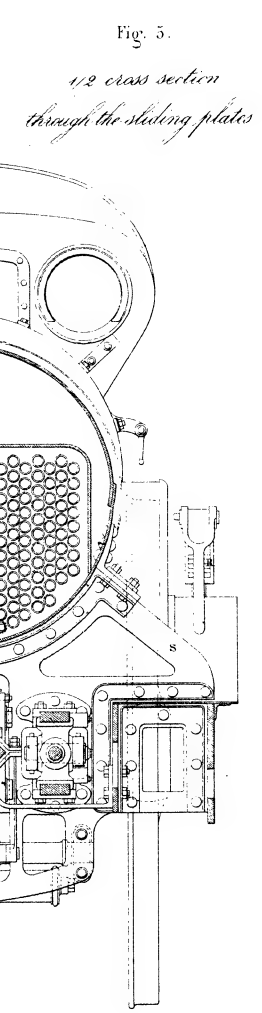
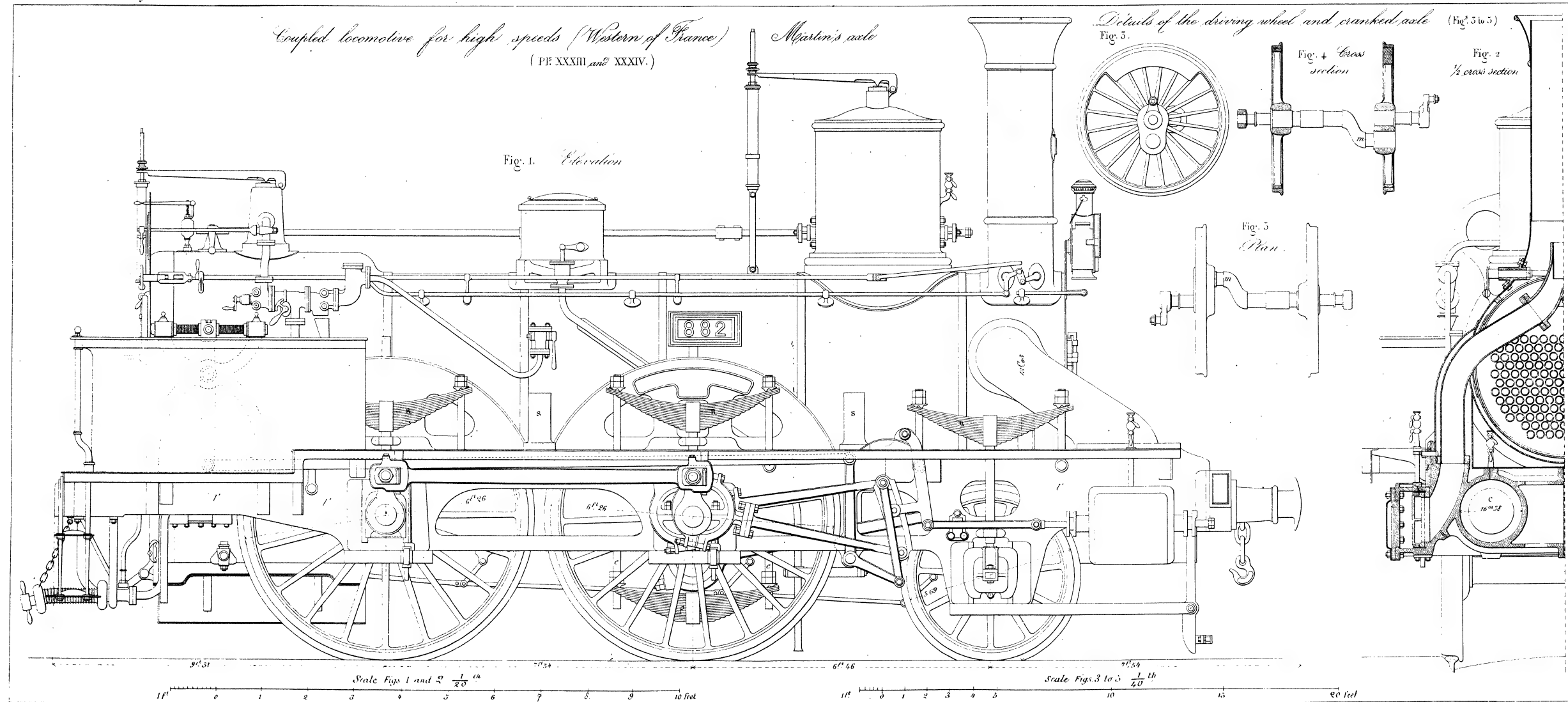


Fig. 5.  
*1/2 cross section  
through the sliding plates*











*Coupled Locomotive for high speeds (Western of France)*

(Pl. XXXIII and XXXIV.)

*(Morton's axle)*

Fig. 1. *Longitudinal section*

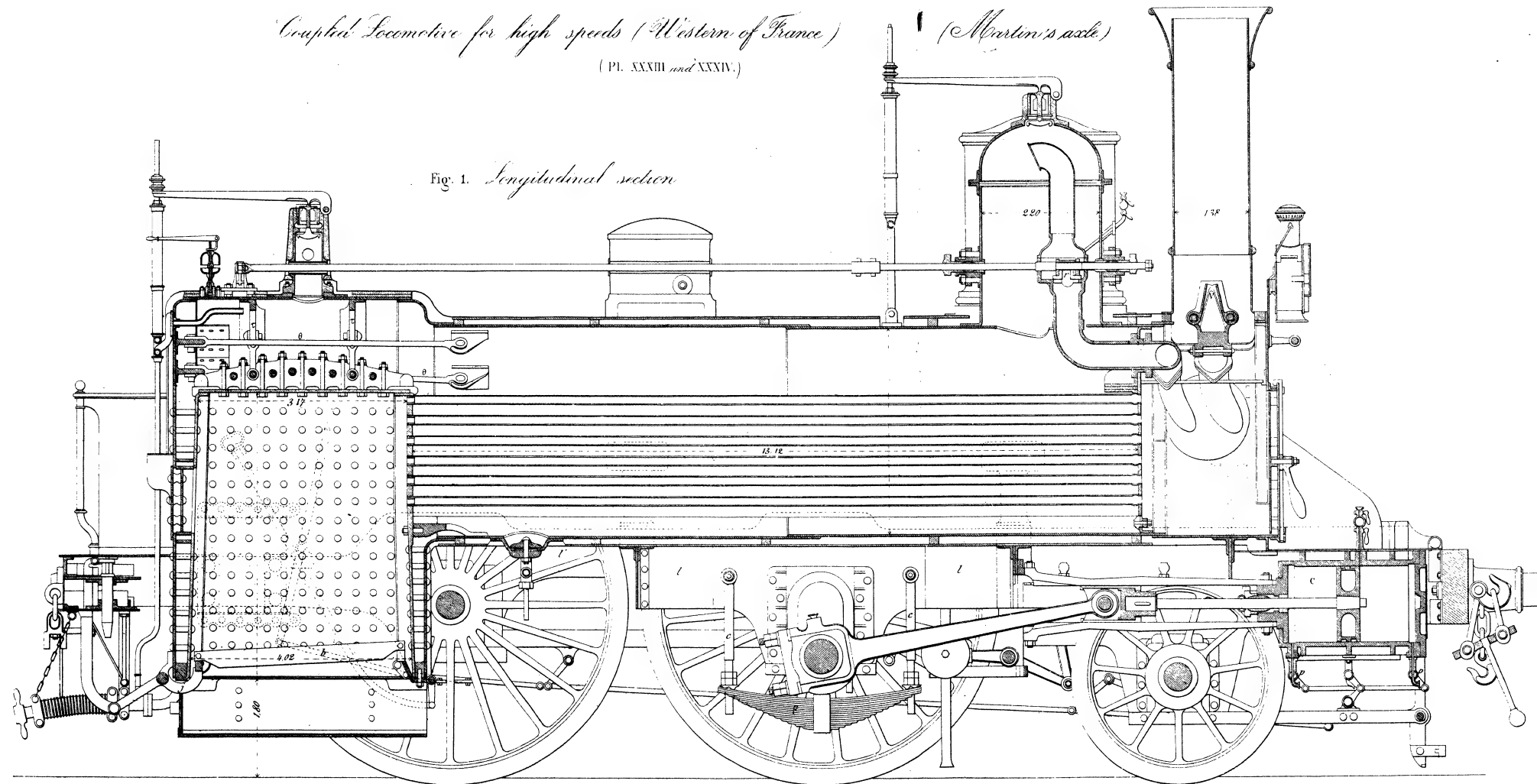
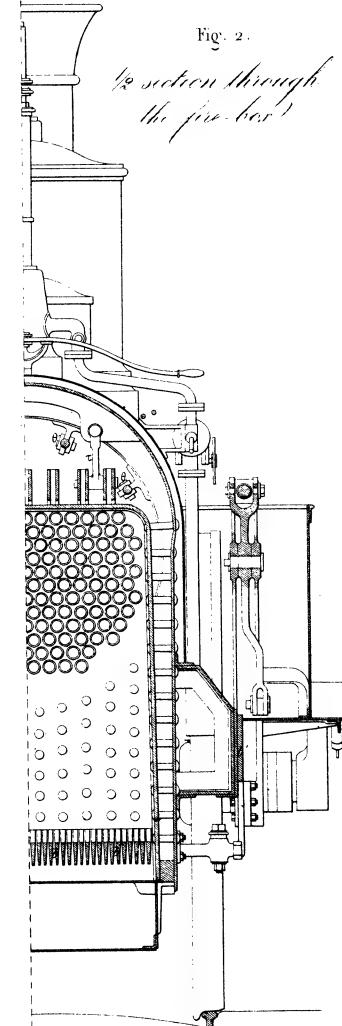


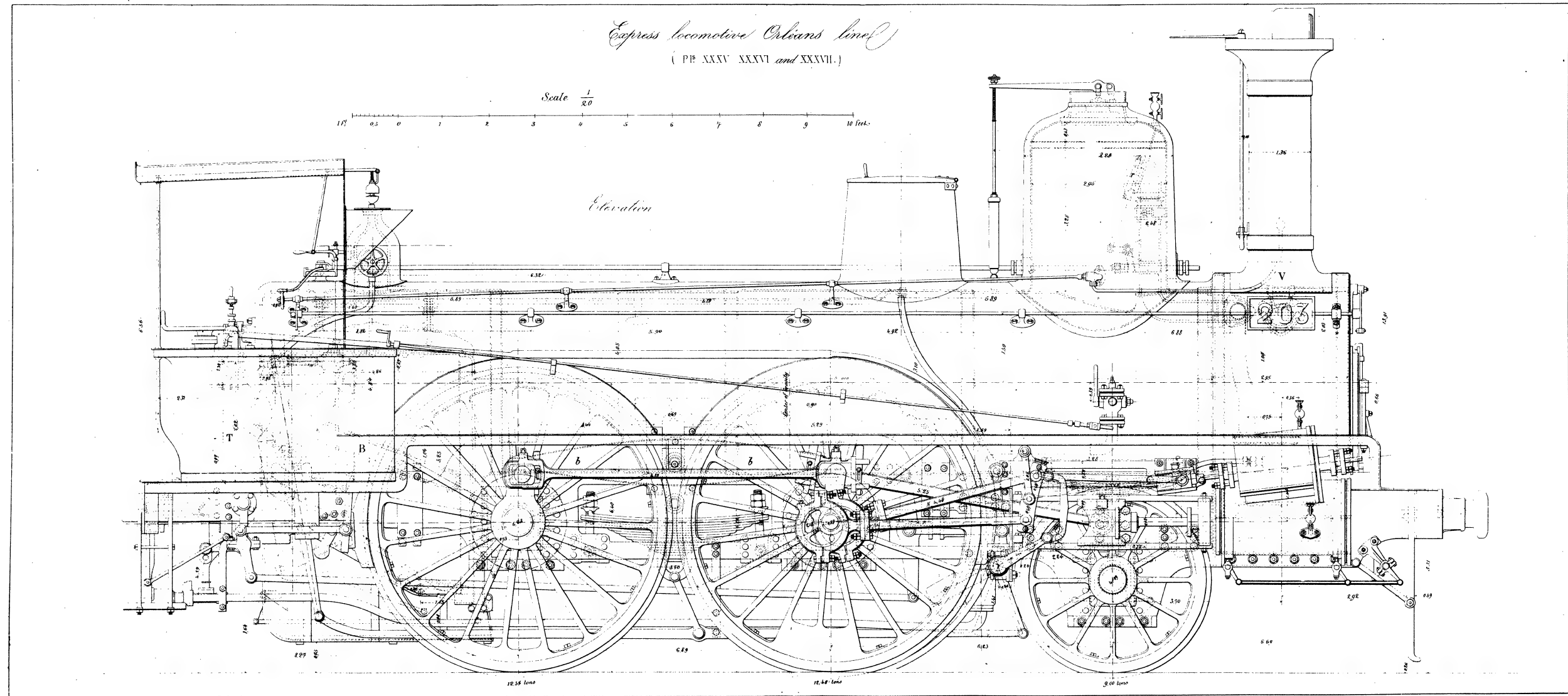
Fig. 2.

*1/2 section through the fire-bar*



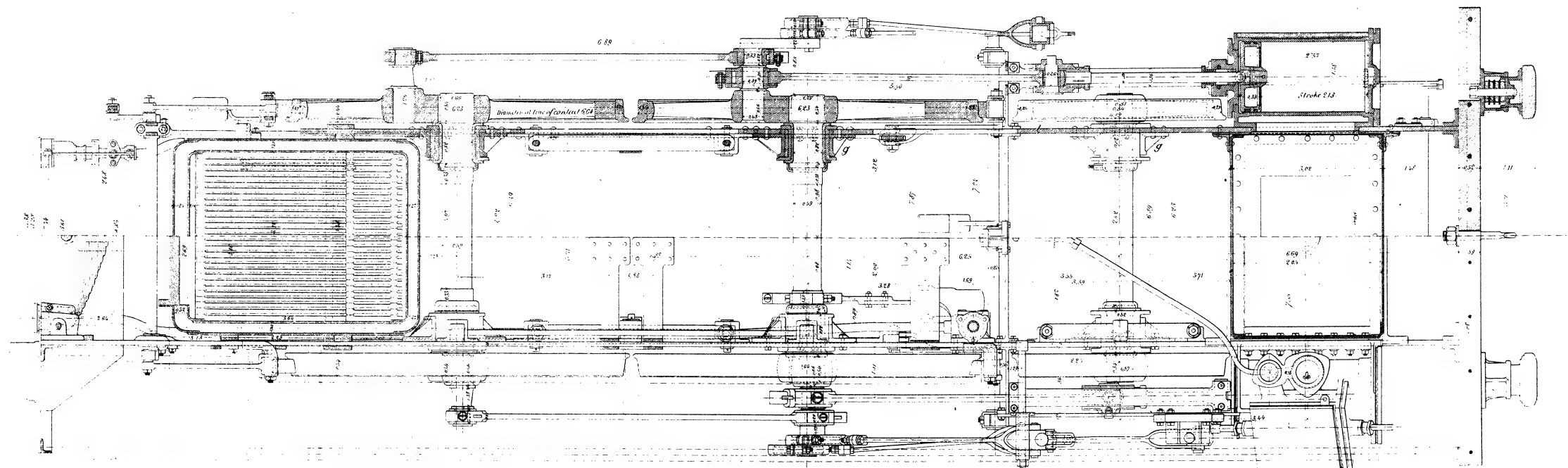


SIX WHEELED LOCOMOTIVES WITH FOUR COUPLED





*Express locomotive Orleans line*  
(Pls XXIV, XXXVI and XXXVII.)  
*Horizontal section and plan*

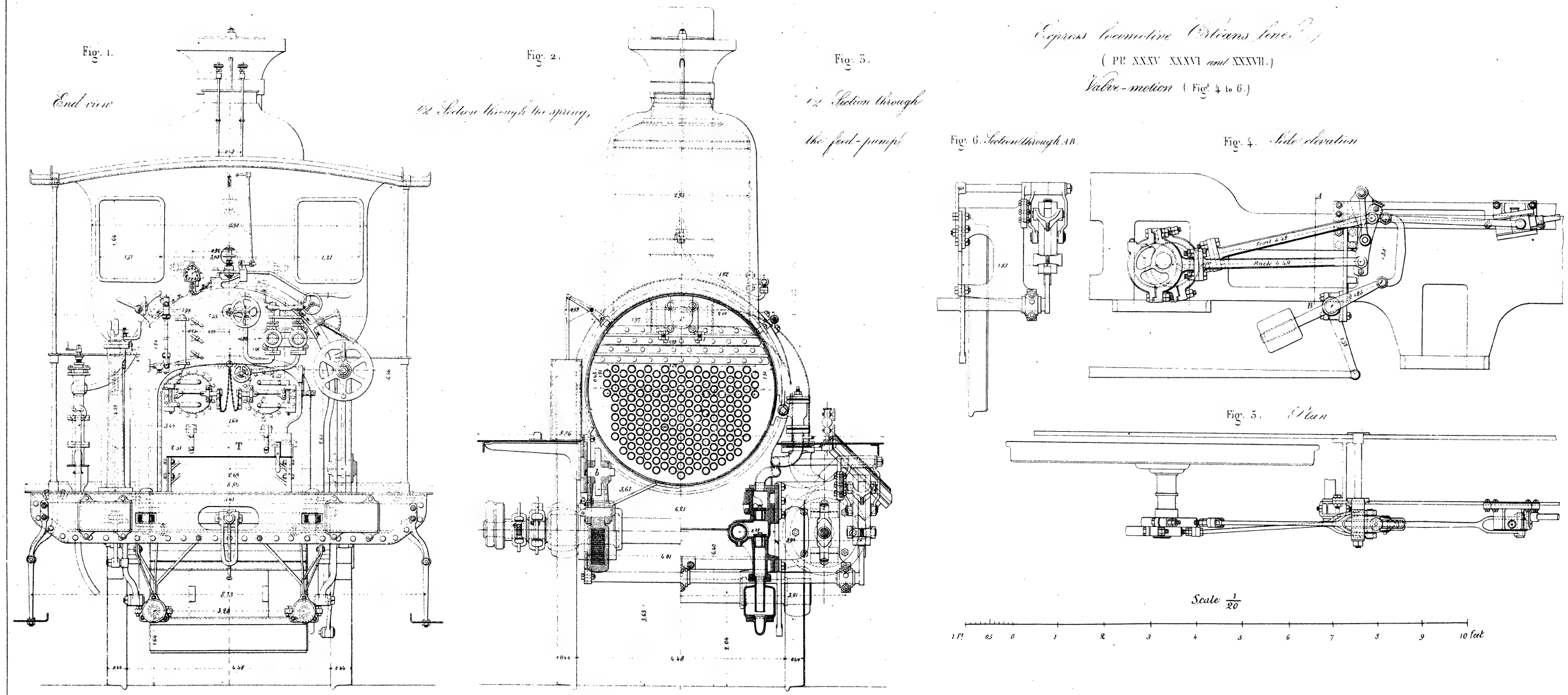


Total length 30.17

Scale  $\frac{1}{80}$

11' 0.5 1 2 3 4 5 6 7 8 9 10 feet





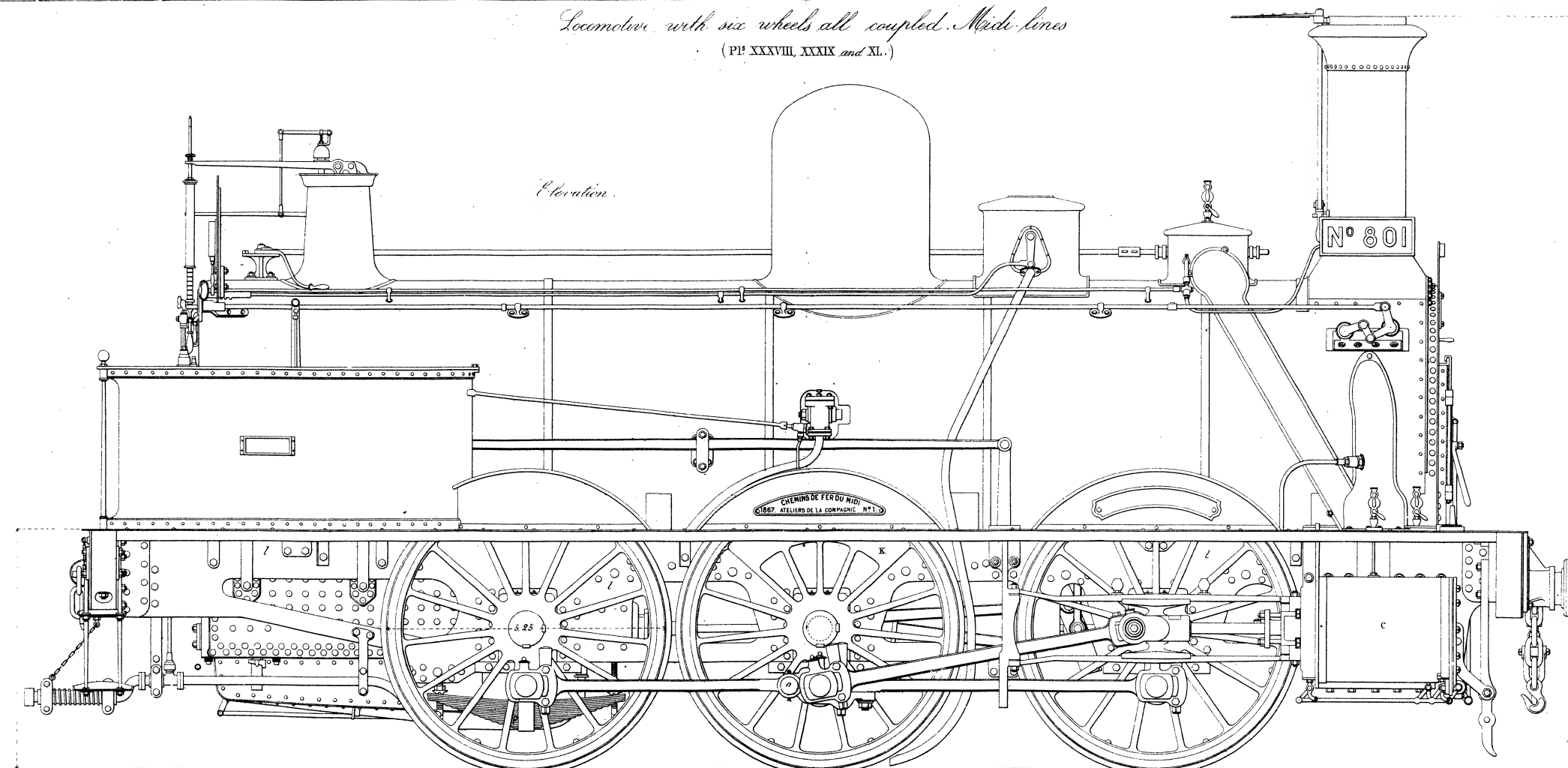




# SIX WHEELED LOCOMOTIVES ALL COUPLED

*Locomotive with six wheels all coupled. Midi lines*  
(Pls XXXVIII, XXXIX and XL.)

*Elevation.*



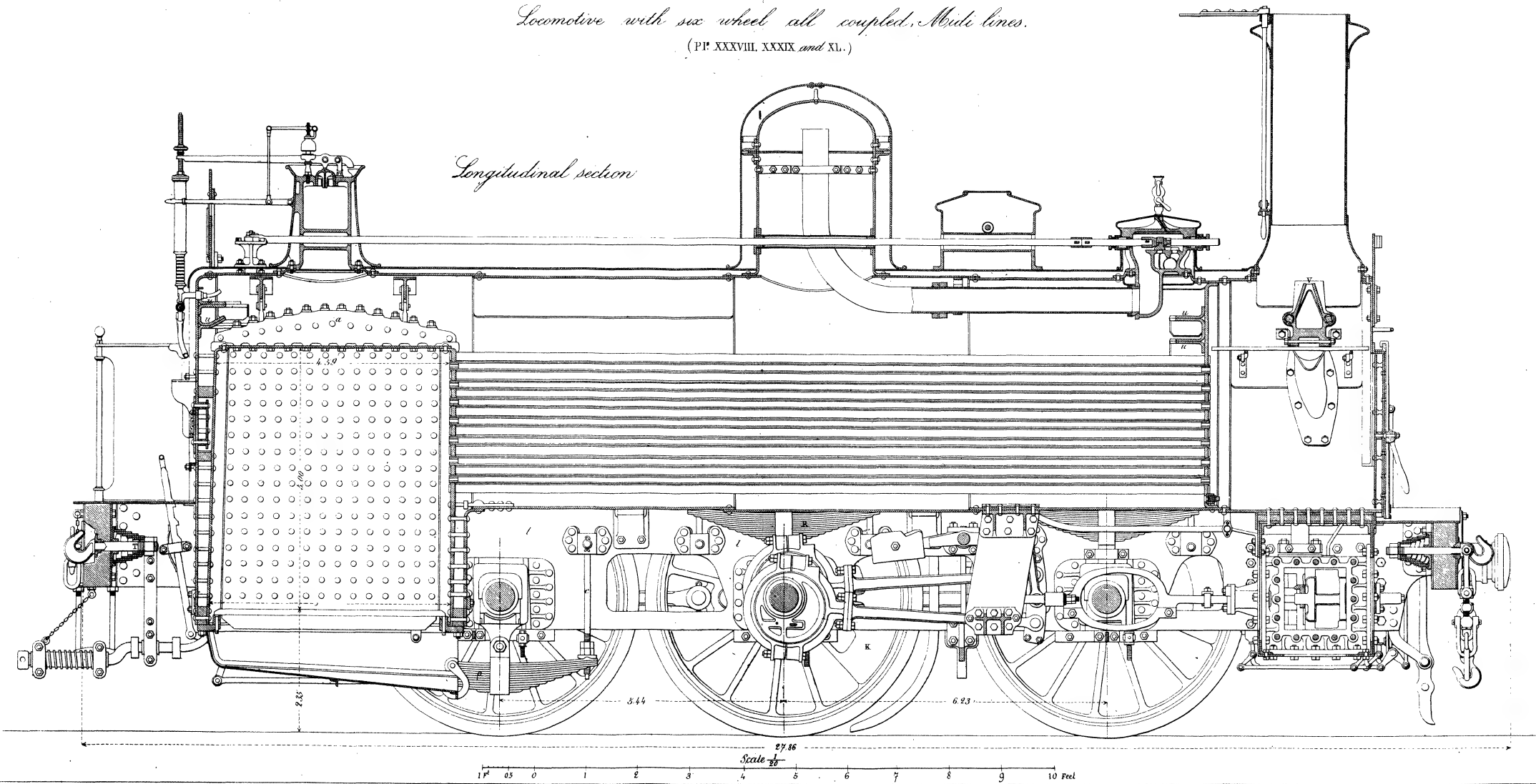
Scale  $\frac{1}{20}$   
1F 0.5 0 1 2 3 4 5 6 7 8 9 10 F



# SIX WHEELED LOCOMOTIVES ALL COUPLED

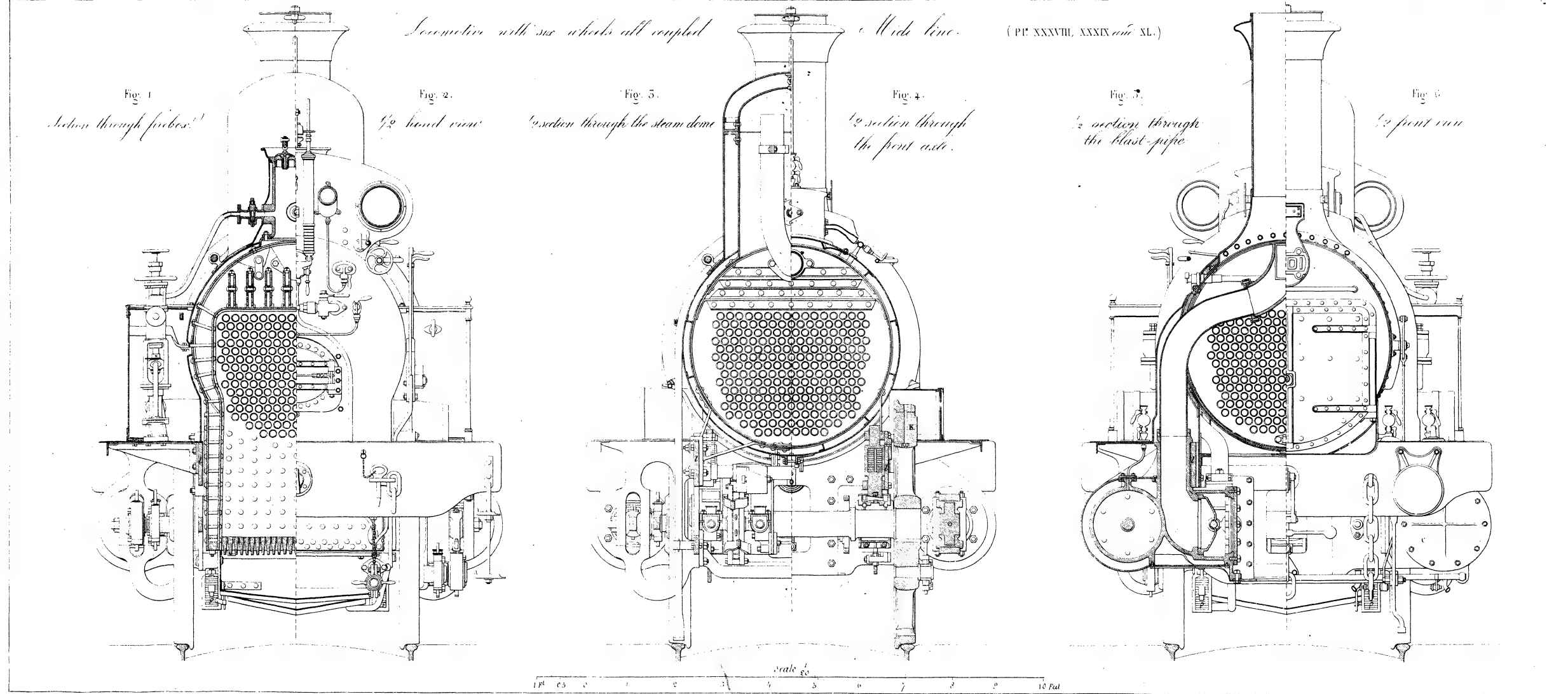
*Locomotive with six wheel all coupled, Midi lines.*  
(Pl. XXXVIII, XXXIX, and XL.)

*Longitudinal section*





# SIX WHEELED LOCOMOTIVES ALL COUPLED





SIX WHEELED LOCOMOTIVES ALL COUPLED

*Locomotive with six wheels all coupled (Western of France)*  
(Pl. XII and XIII.)

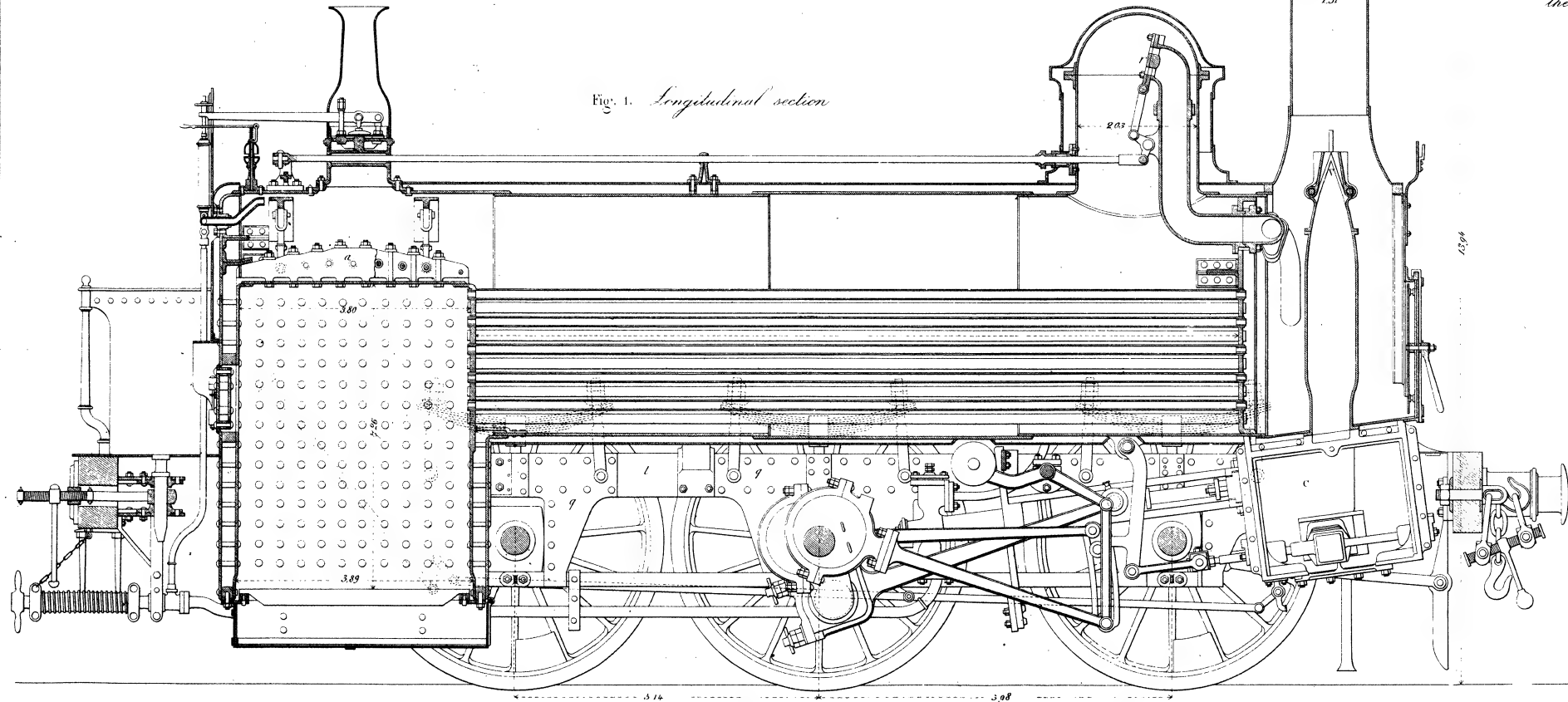


Fig. 1. *Longitudinal section*

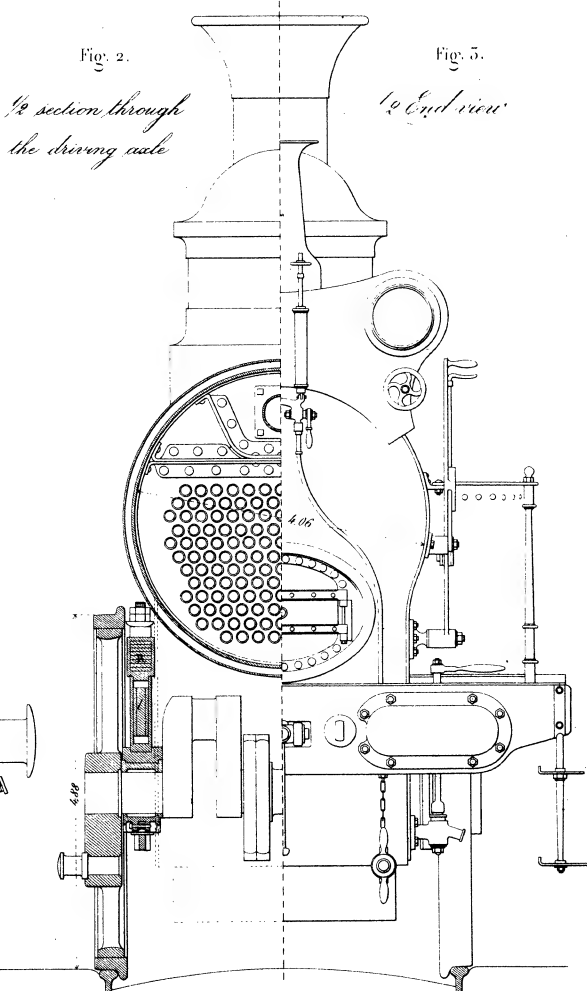


Fig. 2.

*Section through  
the driving axle*

Fig. 3.

*End view*

Scale  $\frac{1}{100}$   
1 ft. 0 in. 0 1 2 3 4 5 6 7 8 9 10 Feet

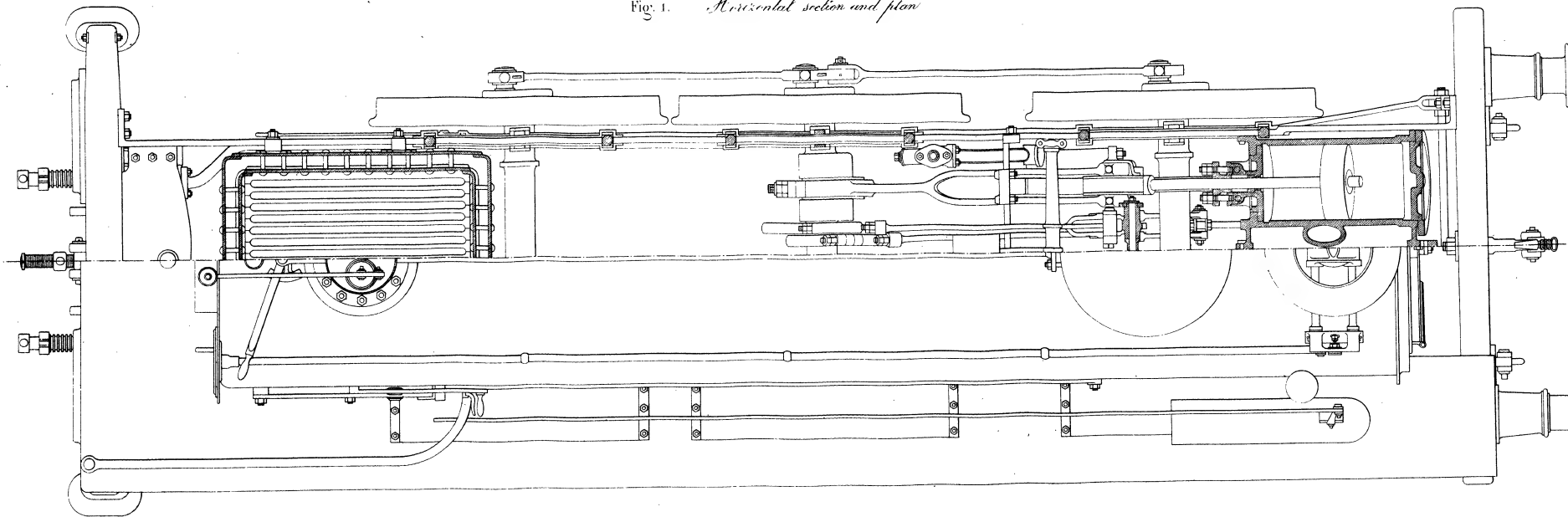




# SIX WHEELED LOCOMOTIVES ALL COUPLED

*Locomotive with six wheels all coupled. Western of France*  
(Pl. XLII and XLIII.)

Fig. 1. *Horizontal section and plan*



Scale  $\frac{1}{20}$

10 Feet

Fig. 2.

*Section through the fire box*

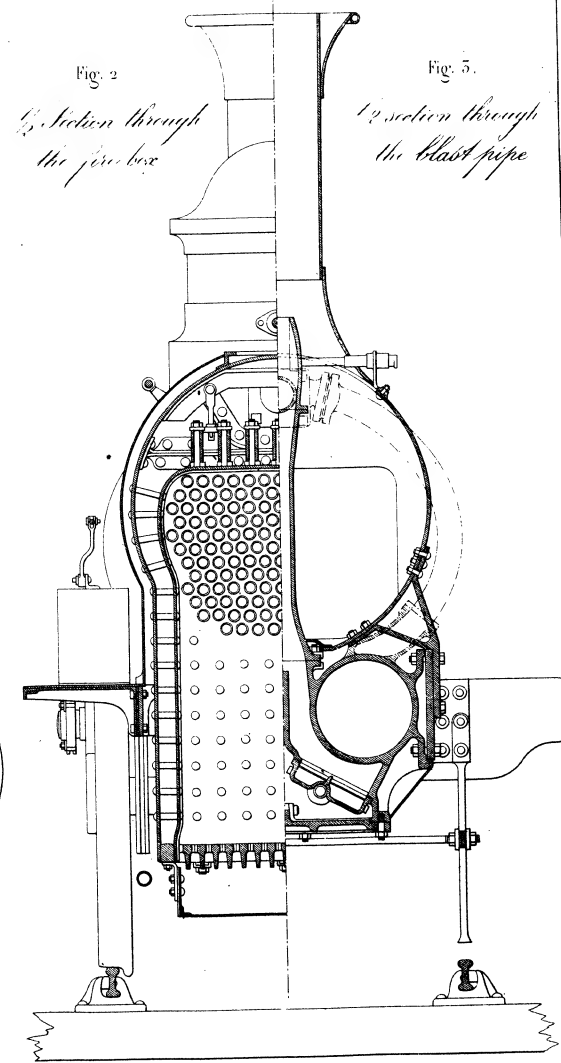


Fig. 3.

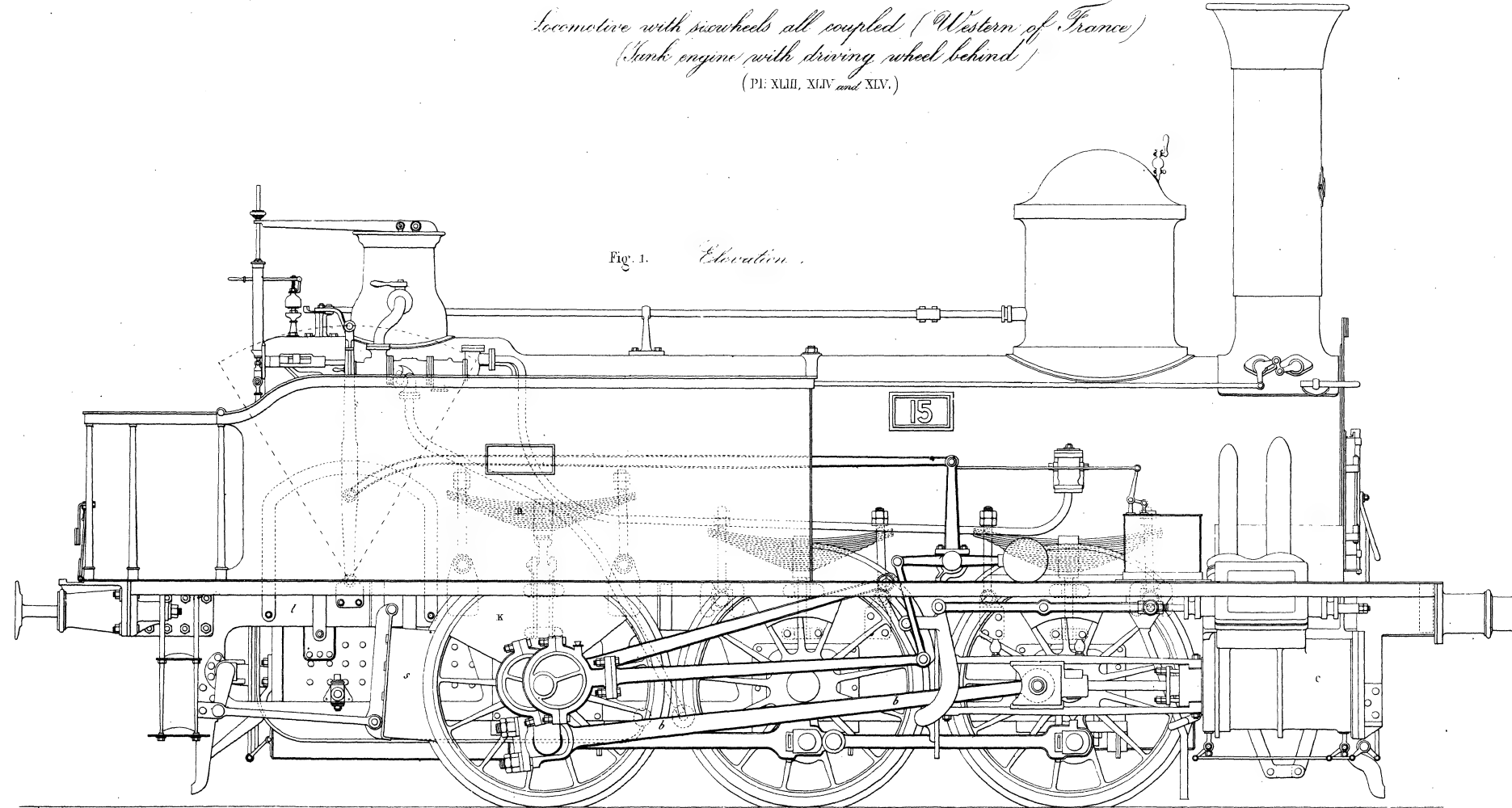
*Section through the blast pipe*



SIX WHEELED LOCOMOTIVES ALL COUPLED

*Locomotive with sixwheels all coupled (Western of France)  
(link engine with driving wheel behind)  
(Pl: XLIII, XLIV and XLV.)*

Fig. 1. *Elevation.*



Scale -  $\frac{1}{10}$

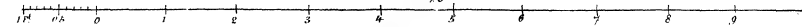
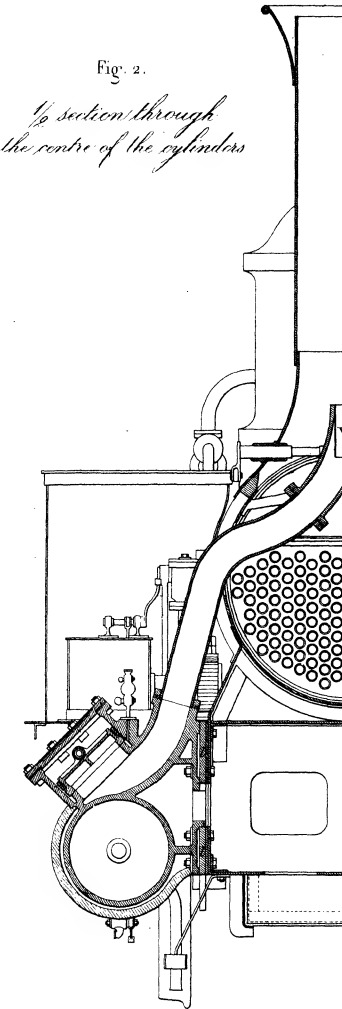


Fig. 2.

*1/2 section through  
the centre of the cylinders*

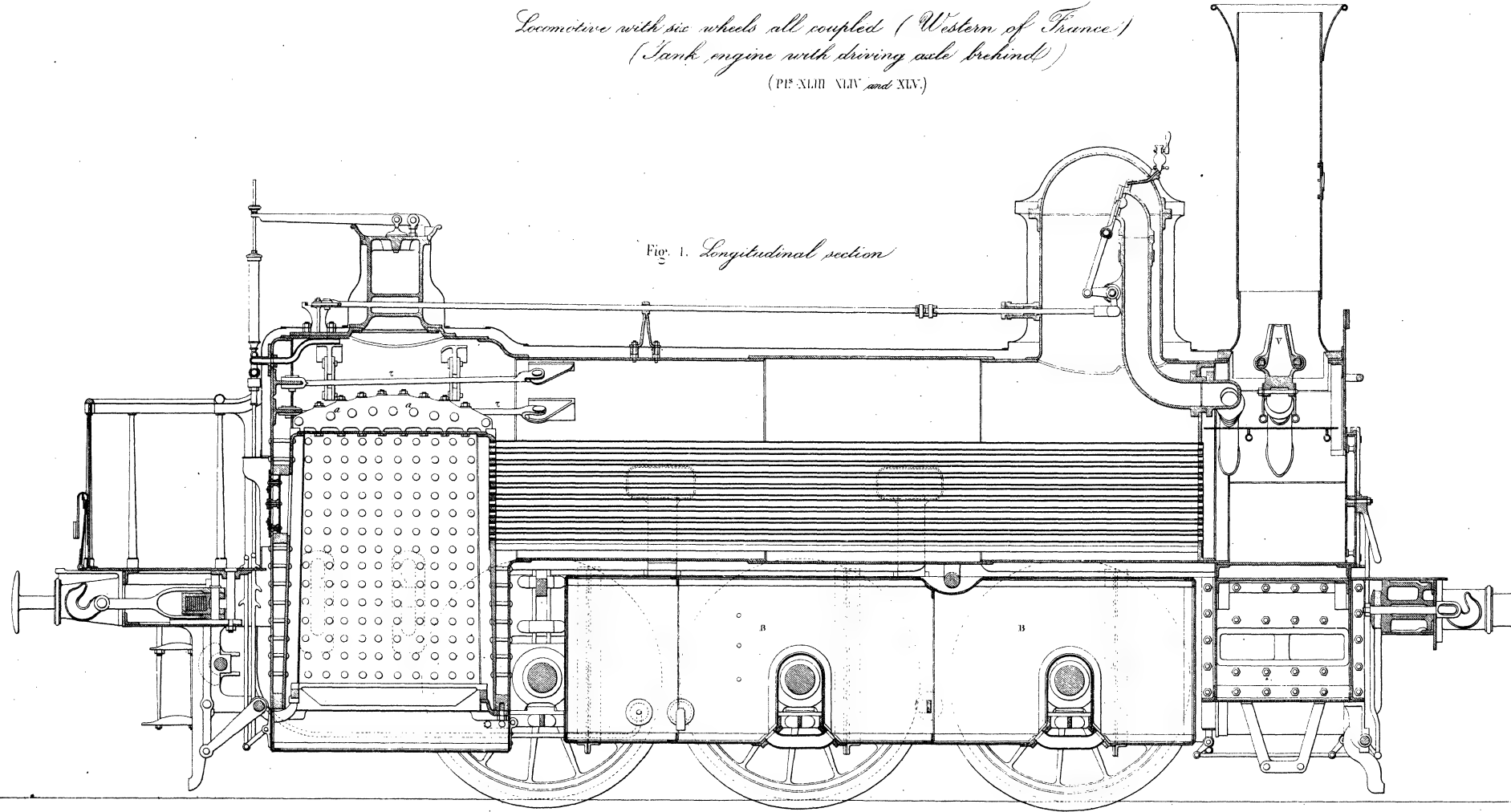




# SIX WHEELED LOCOMOTIVES ALL COUPLED

*Locomotive with six wheels all coupled (Western of France)  
(Tank engine with driving axle behind)  
(Pls XLIII XLIV and XLV.)*

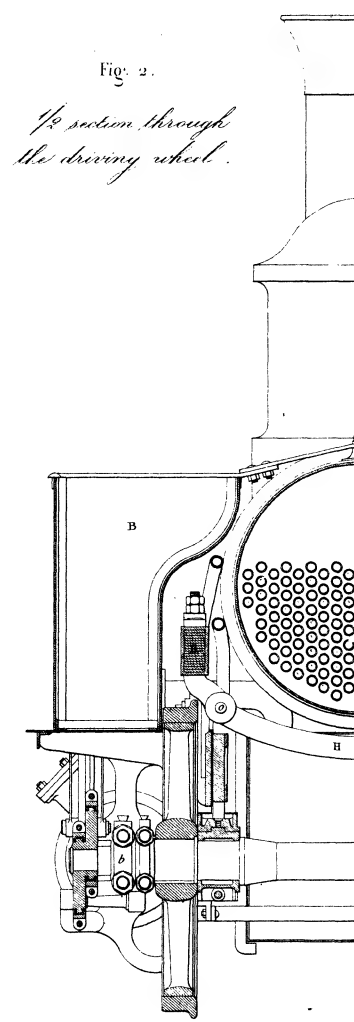
Fig. 1. Longitudinal section



Scale  $\frac{1}{80}$   
1 2 3 4 5 6 7 8 9 10 feet

Fig. 2.

*1/2 section through  
the driving wheel.*

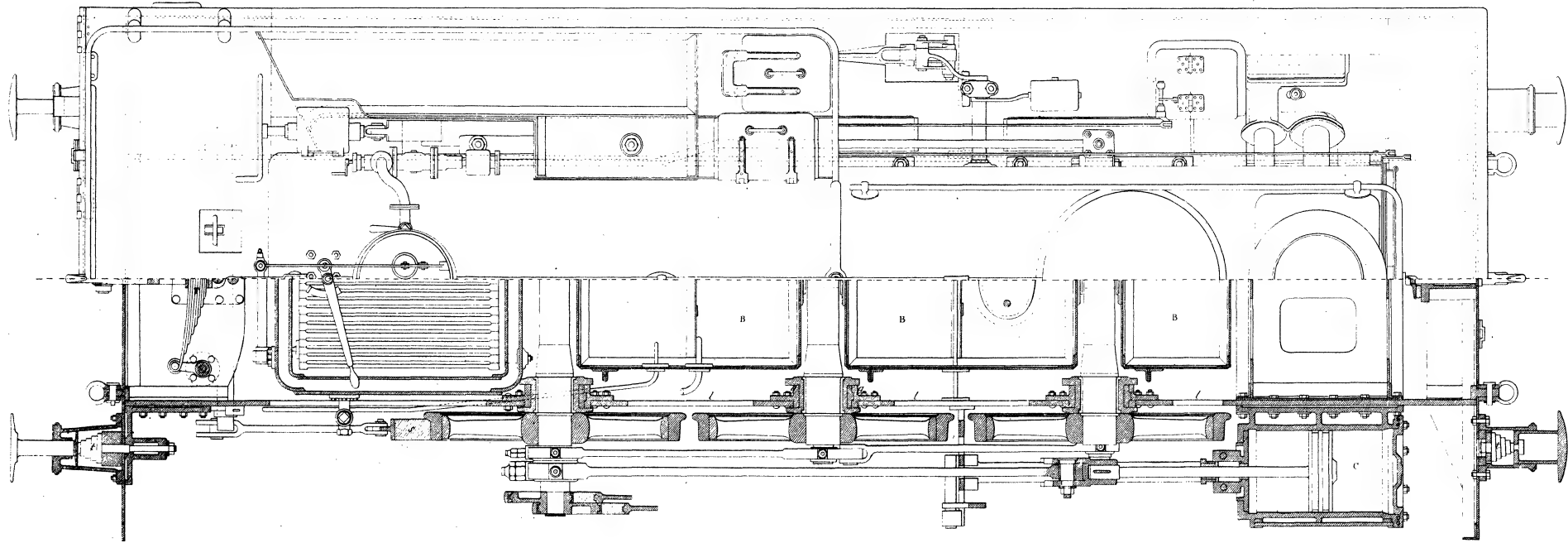




SIX WHEELED LOCOMOTIVES ALL COUPLED

*Locomotive with six wheels all coupled. Western of France.  
Tank engine with driving wheels behind.  
(Pls XLIII, XLIV and XLV.)*

Fig. 1. *Plan and horizontal section.*

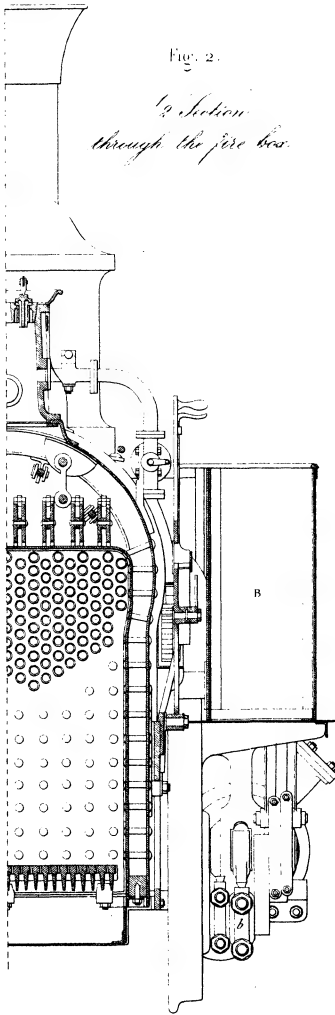


Scale  $\frac{1}{20}$

10 9 8 7 6 5 4 3 2 1 0 0.5 1 ft

Fig. 2.

*Section through the fire box.*







SIX WHEELED LOCOMOTIVES ALL COUPLED

*Tank locomotive with six wheels all coupled constructed at the Creusot works*  
(Pls XLVI and XLVII.)

Fig. 1. *Elevation.*

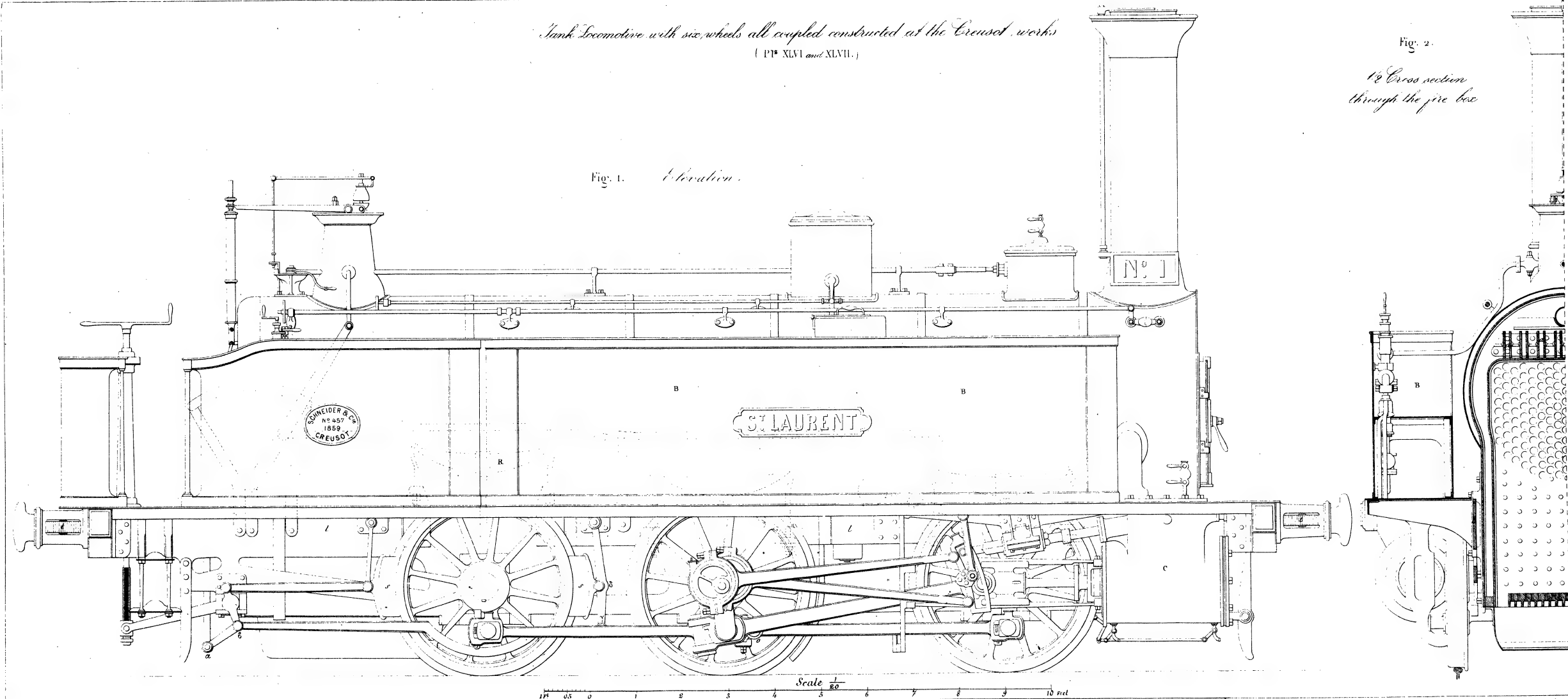


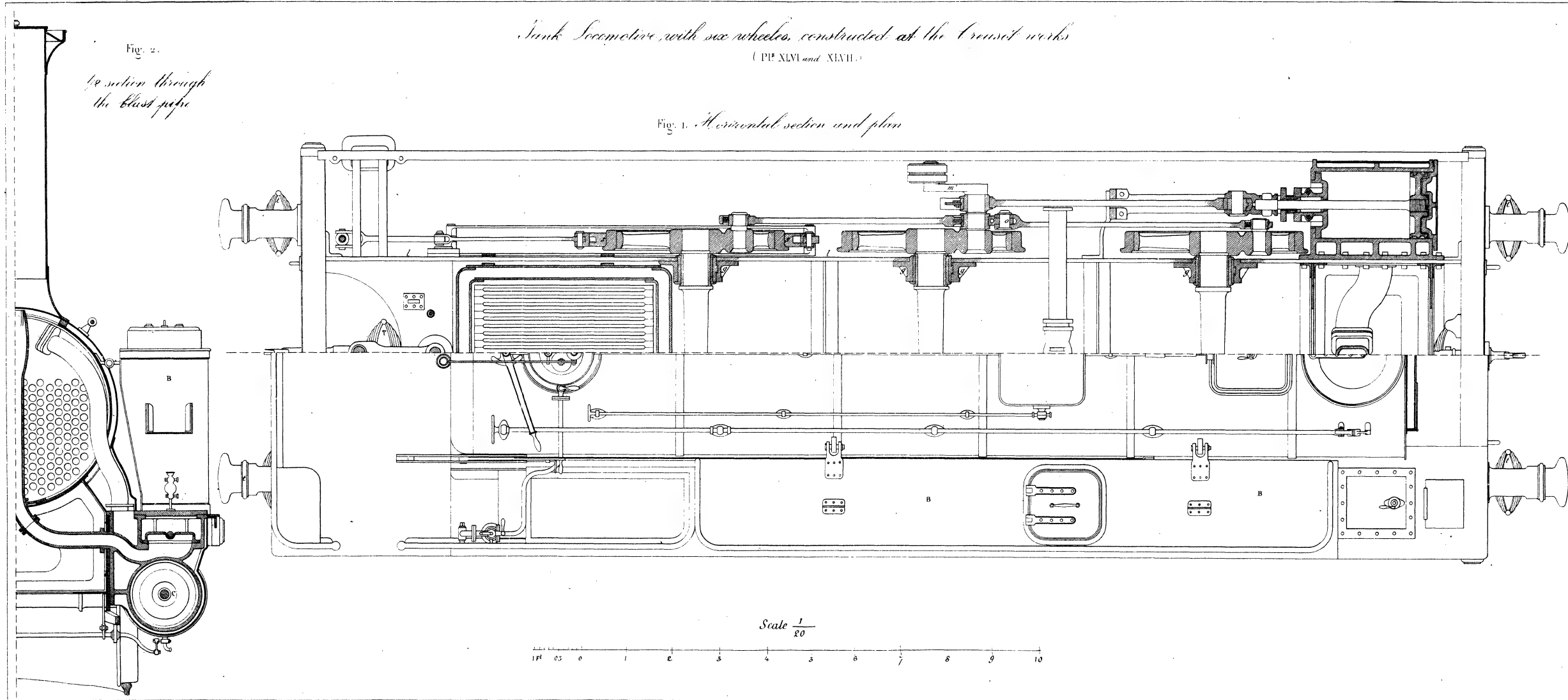
Fig. 2.

*1/2 Cross section  
through the fire box*

*Lemaire del et sc.*

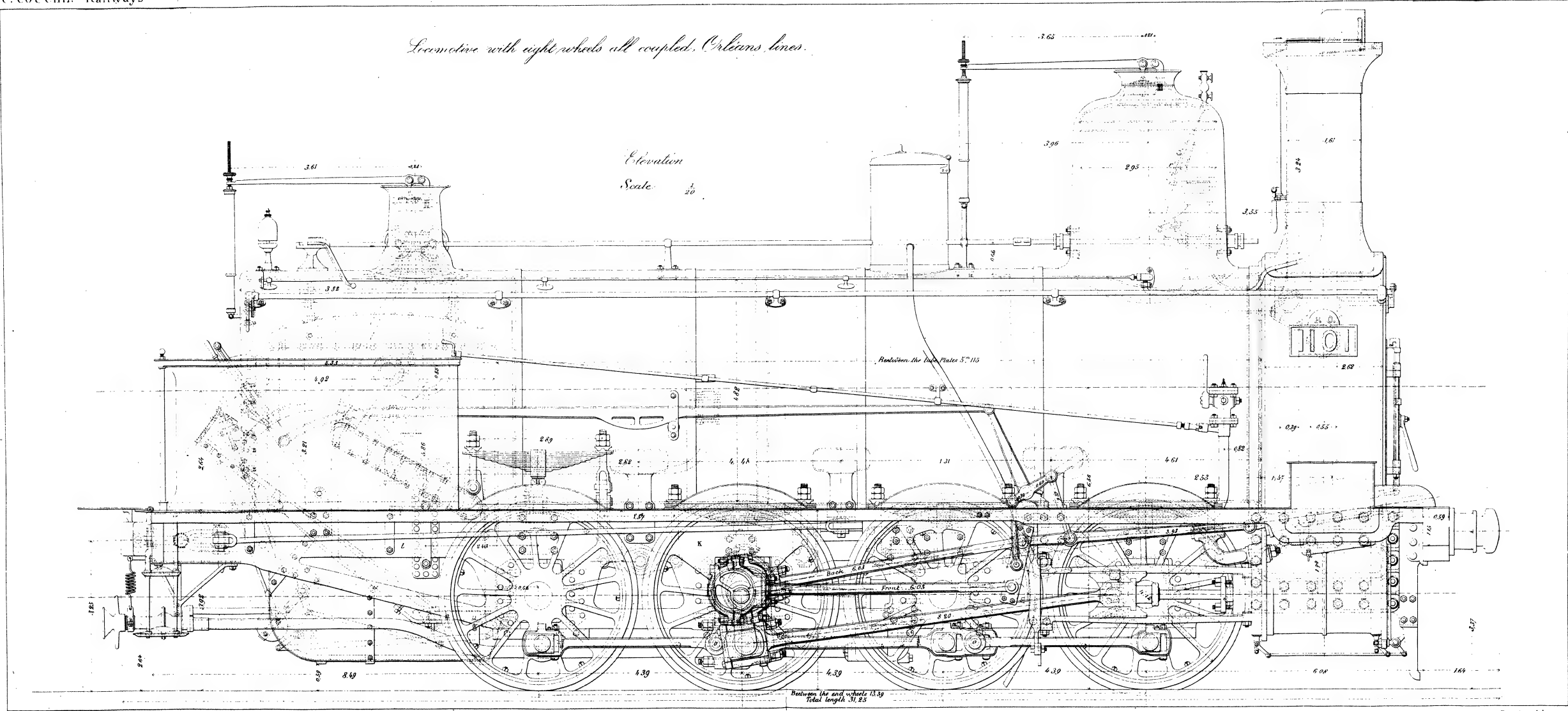


# SIX WHEELED LOCOMOTIVES ALL COUPLED





EIGHT WEELED LOCOMOTIVES ALL COUPLED

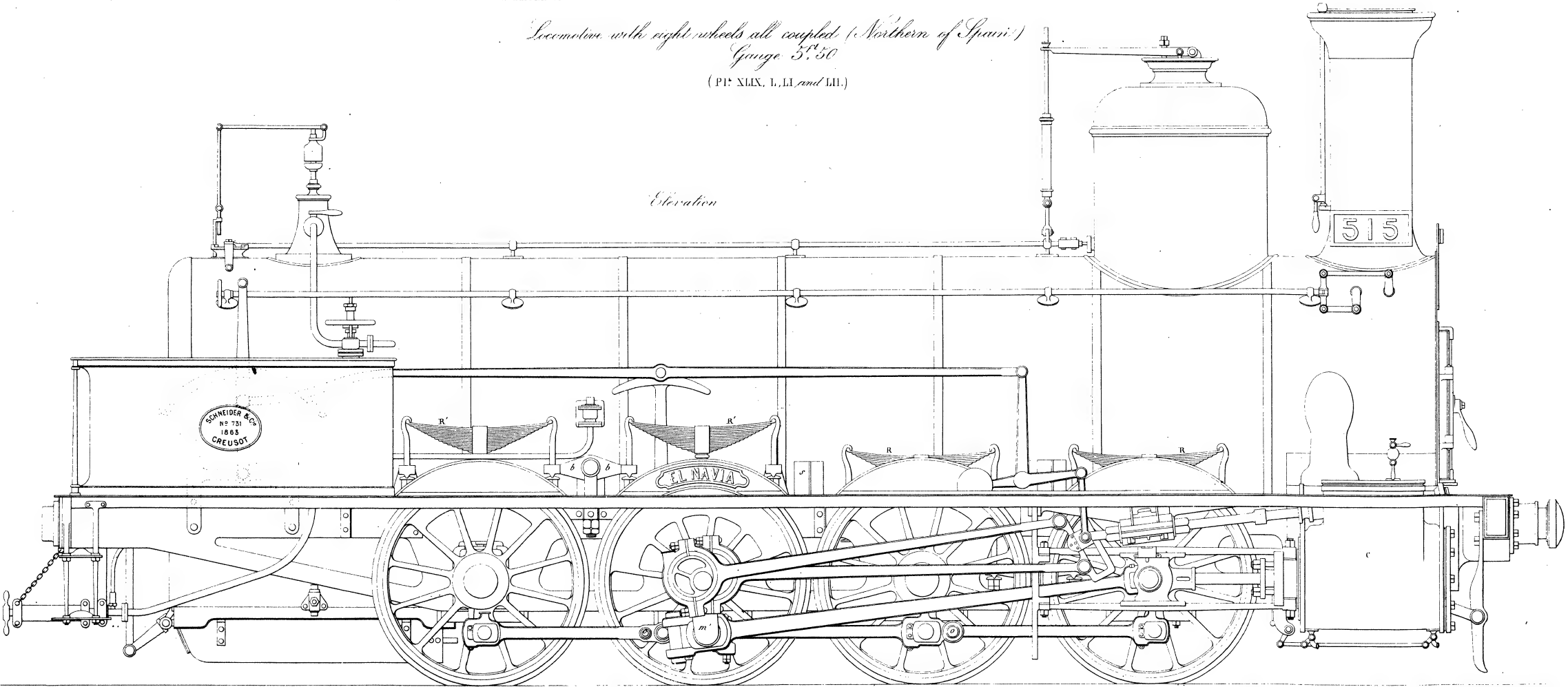




EIGHT WEELED LOCOMOTIVES ALL COUPLED

*Locomotive with eight wheels all coupled (Northern of Spain):*  
*Gauge 5' 50"*  
*(Pls XLIX, L, LI and LII.)*

*Elevation*



*Scale  $\frac{1}{20}$*

1 ft 0.5 0 1 2 3 4 5 6 7 8 9 10 Feet

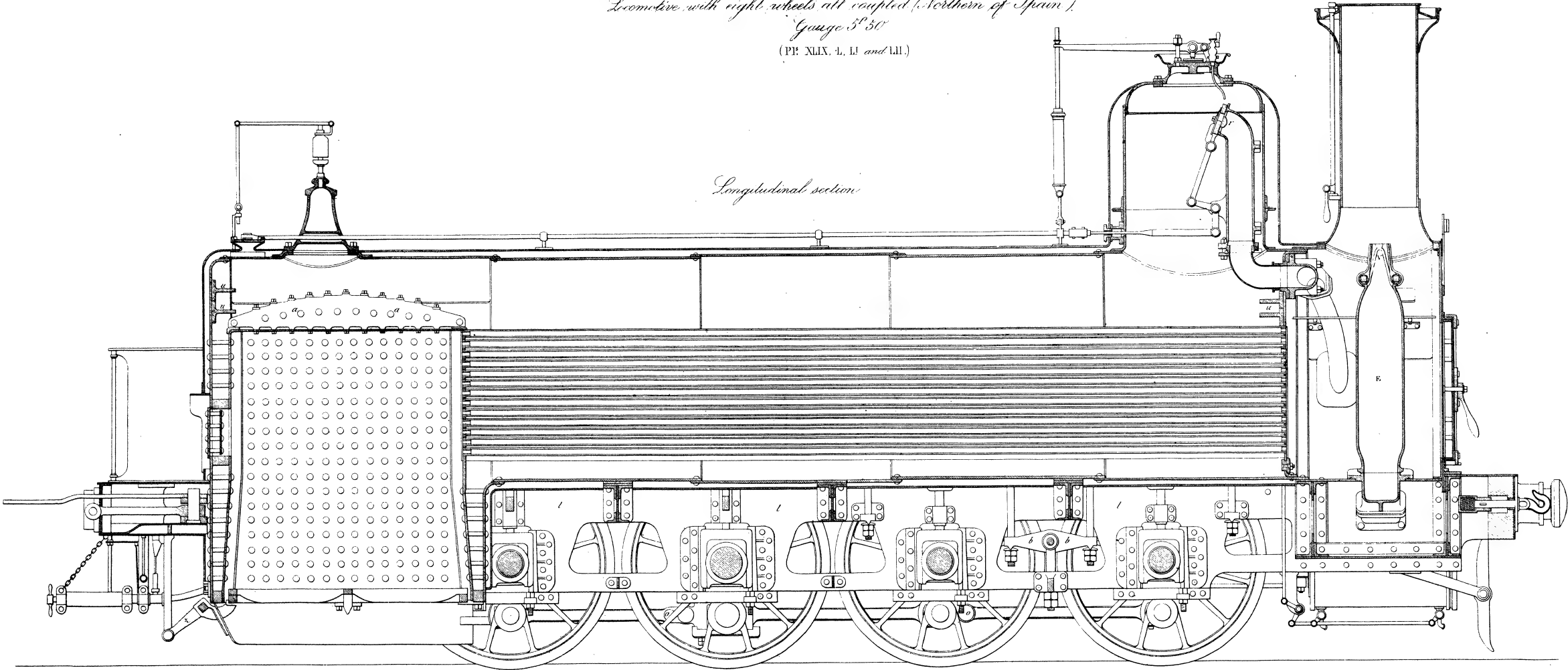




EIGHT WEELED LOCOMOTIVES ALL COUPLED

*Locomotive with eight wheels all coupled (Northern of Spain),  
Gauge 5' 3"*  
(Pl. XLIX. A, B and III.)

*Longitudinal section*



Scale  $\frac{1}{20}$   
10 Feet

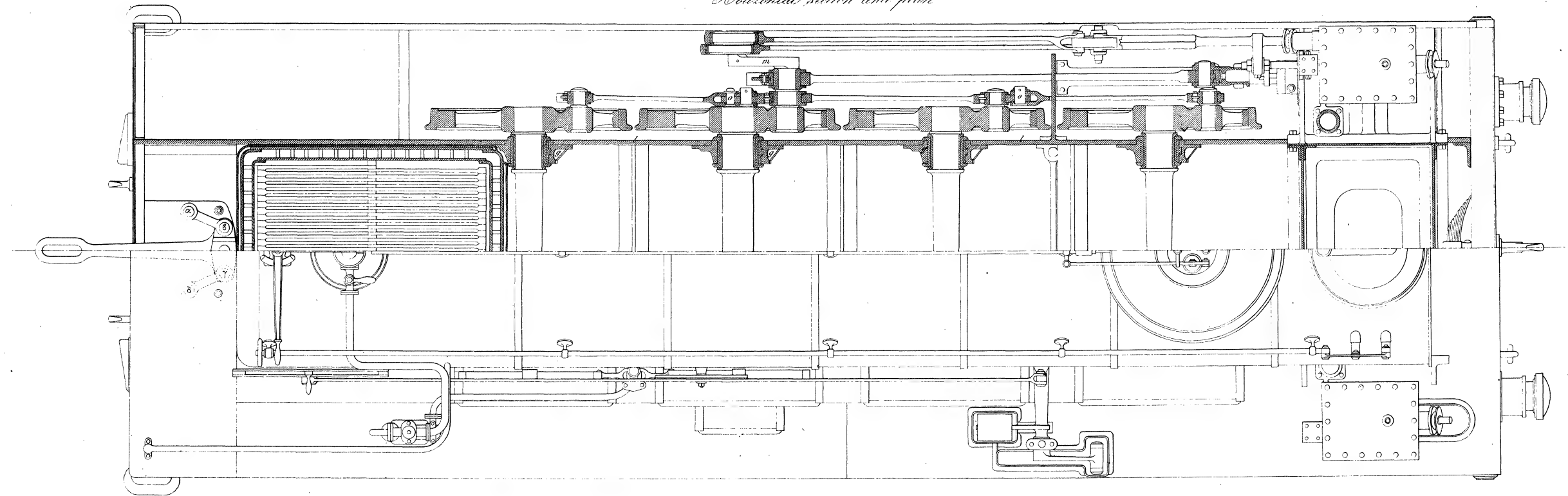


# EIGHT WHEELED LOCOMOTIVES ALL COUPLED

*Locomotive with eight wheels all coupled (Northern of Spain)  
Gauge 3' 6"*

(Pl. XIX, L. II and LII.)

*Horizontal section and plan*



Scale  $\frac{1}{20}$

3' 6" 0 1 2 3 4 5 6 7 8 9 10 11 12 13 Feet



EIGHT WEELED LOCOMOTIVES ALL COUPLED

Fig. 1.  
*1/2 section through the centre  
of the trailing wheels*

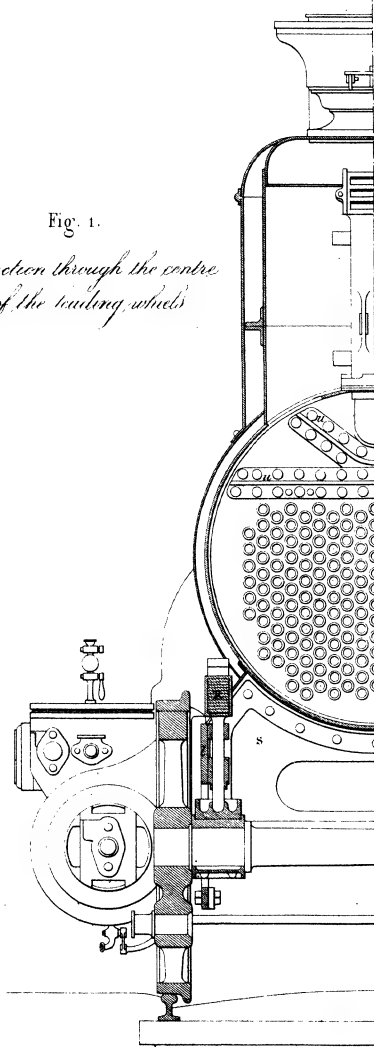


Fig. 2.  
*1/2 section through the blast pipe*

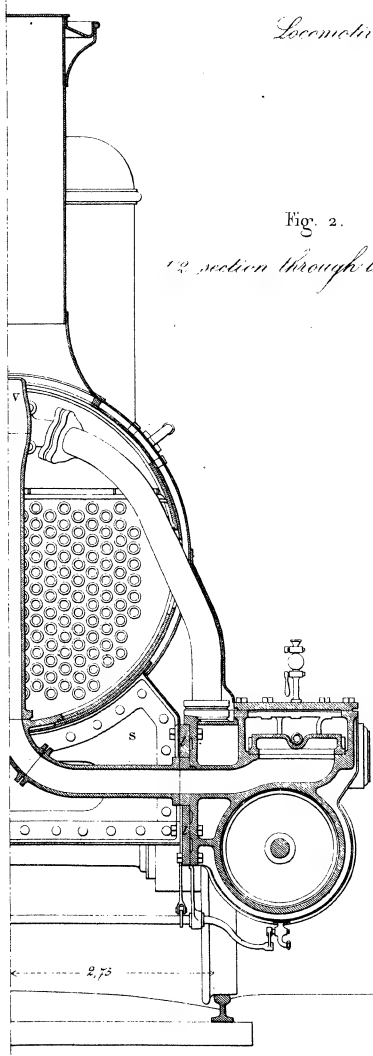


Fig. 3.  
*1/2 section through fire box*

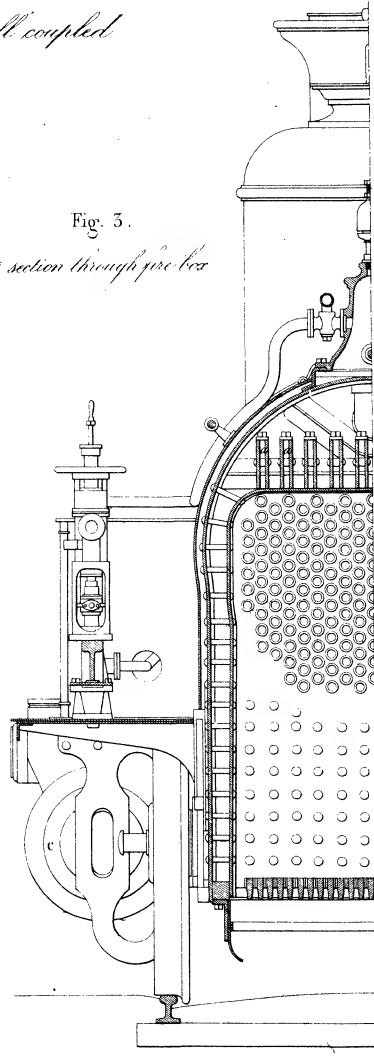
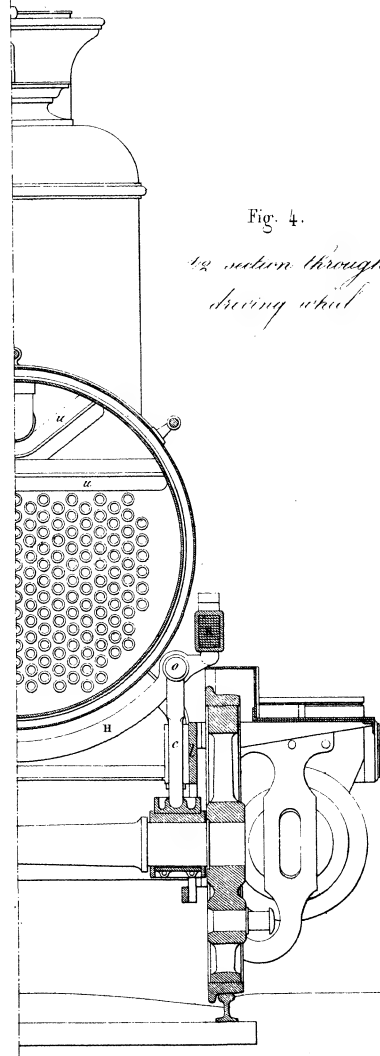


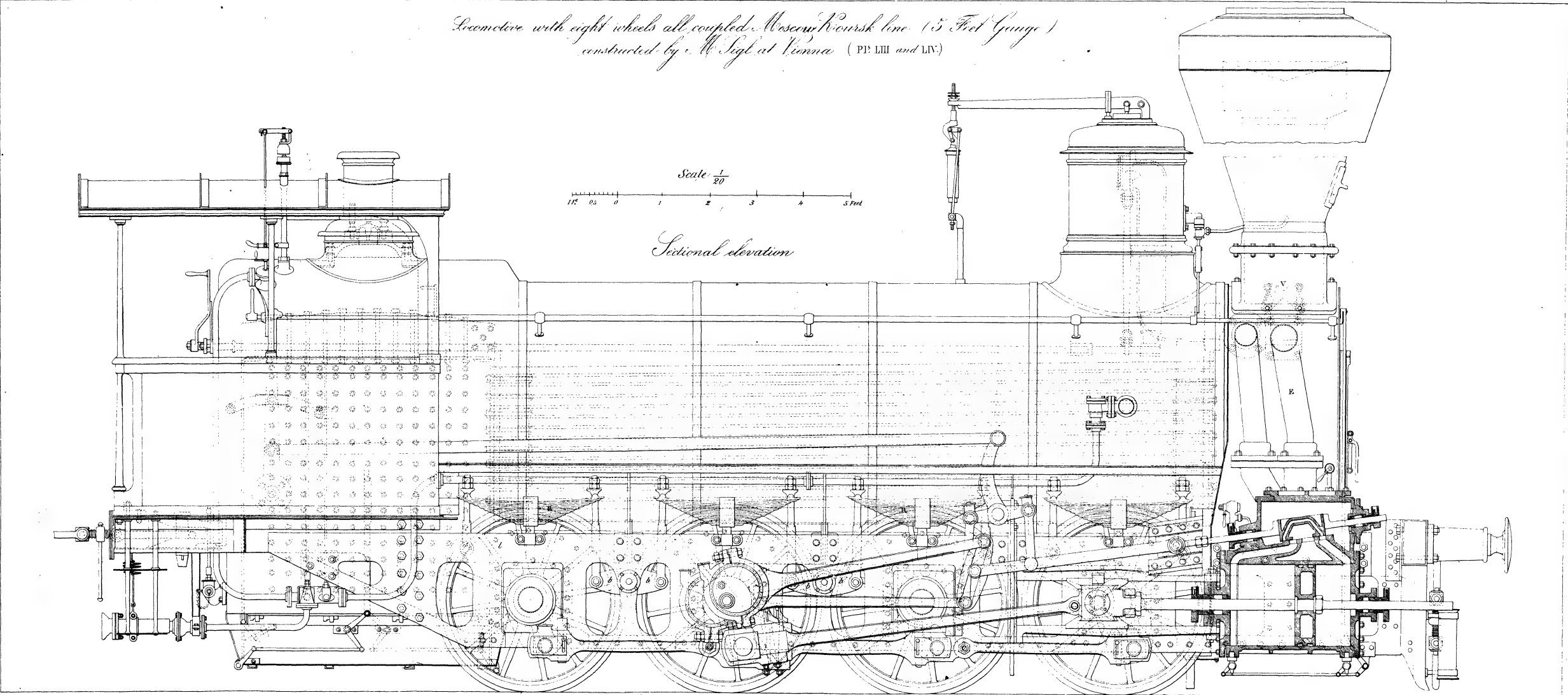
Fig. 4.  
*1/2 section through  
driving wheel*



Scale  $\frac{1}{20}$   
10 6.5 0 1 2 3 4 5 6 7 8 9 10 15 Feet



EIGHT WEELED LOCOMOTIVES ALL COUPLED



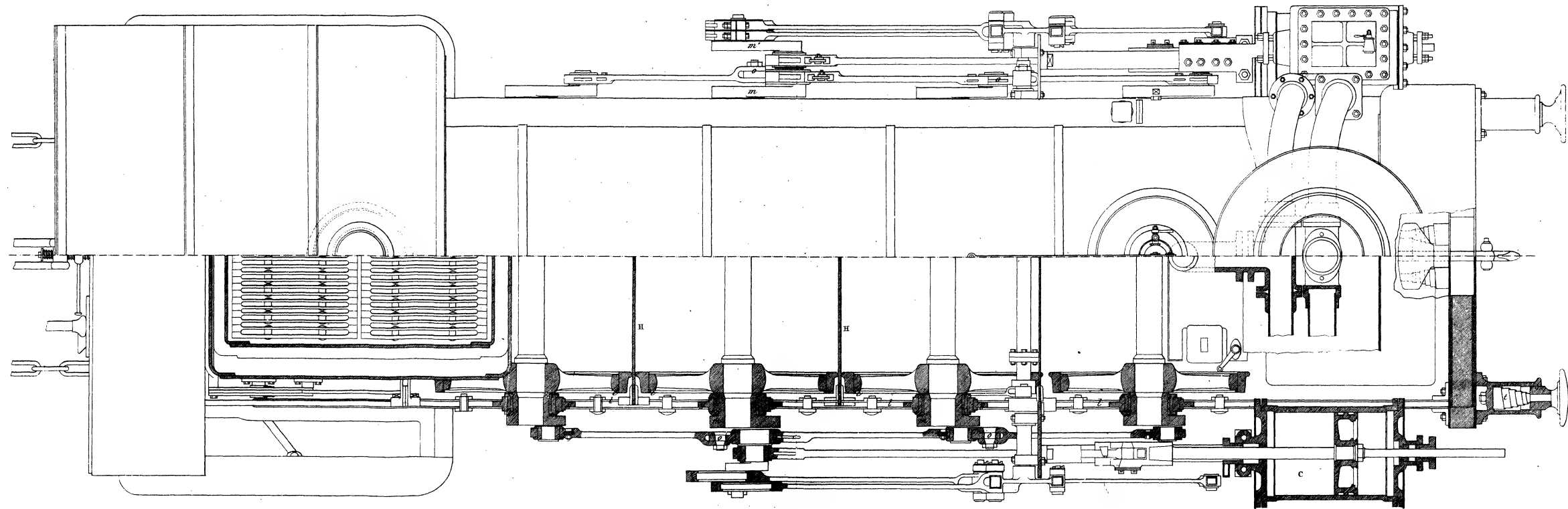




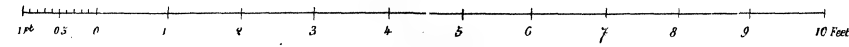
**EIGHT WEELED LOCOMOTIVES ALL COUPLED**

*Locomotive with eight wheels all coupled. Moscow-Koursk line (5 Feet Gauge)  
constructed by M. Sigi at Vienna. (Pls LIII and LIV.)*

*Plan and horizontal section*



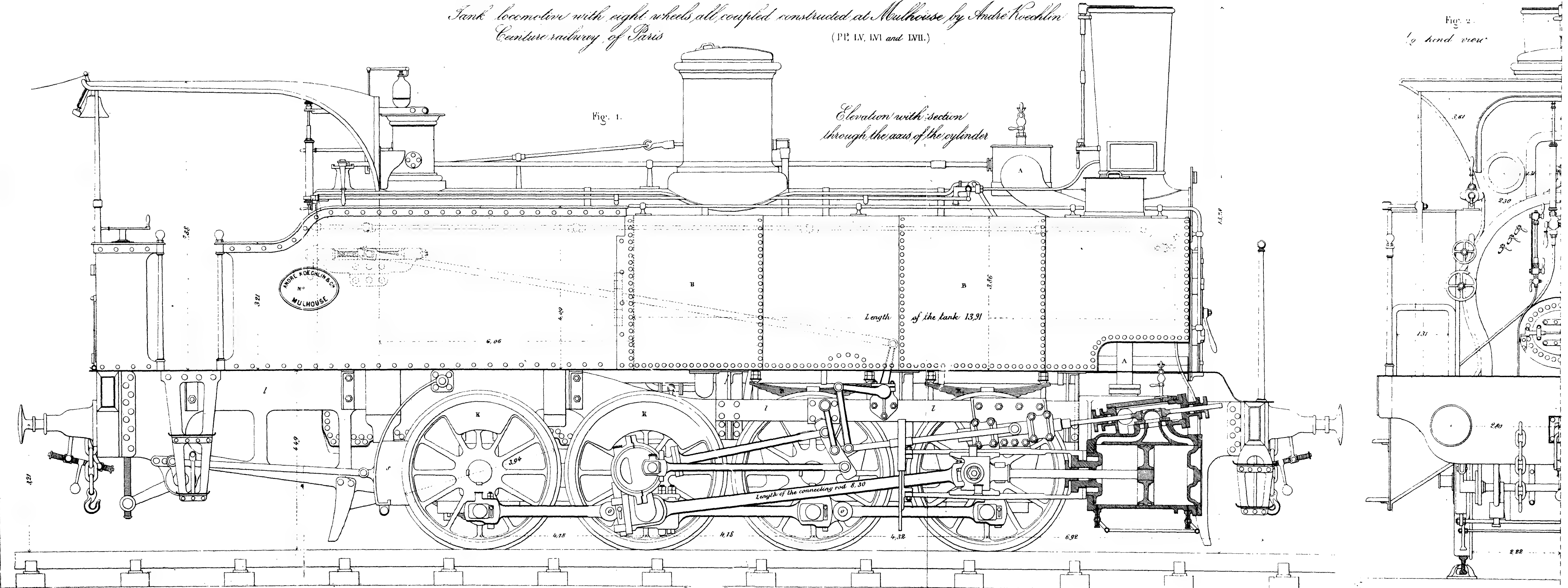
*Scale  $\frac{1}{20}$*





EIGHT WEELED LOCOMOTIVES ALL COUPLED

*Tank locomotive with eight wheels all coupled constructed at Mulhouse by Andre Koechlin*  
*Centrale railway of Paris*  
(Pls. LV, LVI and LVII.)

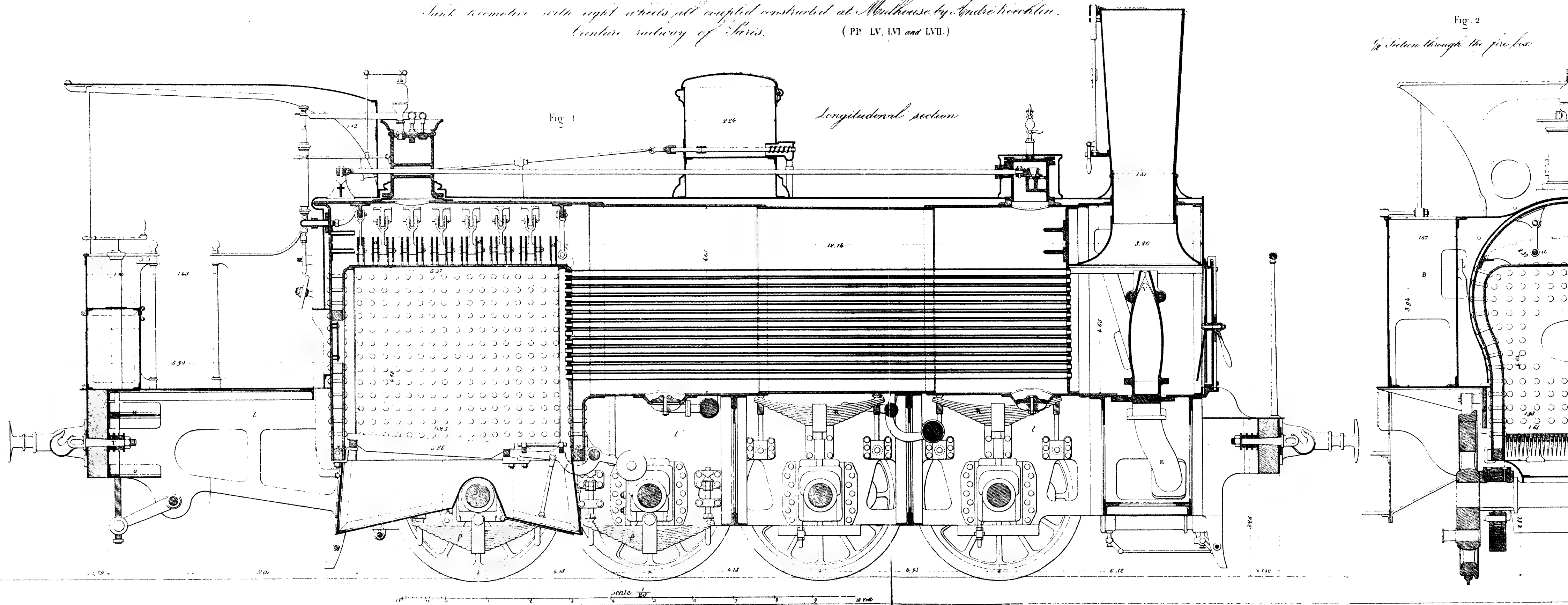




EIGHT WEELED LOCOMOTIVES ALL COUPLED

*Steam locomotive with eight wheels all coupled constructed at Mulhouse by Andre Koechlin.  
Eastern railway of Paris. (Pl. LV, LVI and LVII.)*

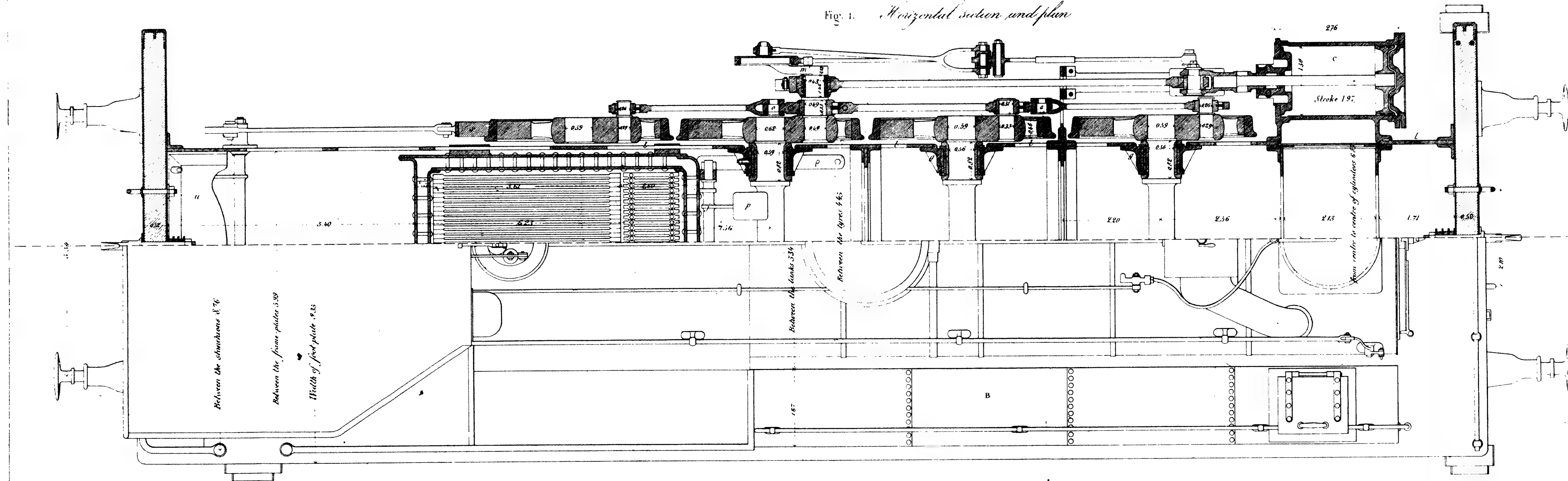
Fig. 2  
*1/2 Section through the fire box.*





*Stark locomotive with eight wheels all coupled constructed at Mulhouse by Emile Krenn  
Grenoble railway of Paris  
(Pls. LV, LVI and LVII.)*

Fig. 1. *Horizontal section and plan*



Scale  $\frac{1}{20}$

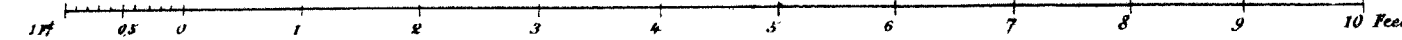
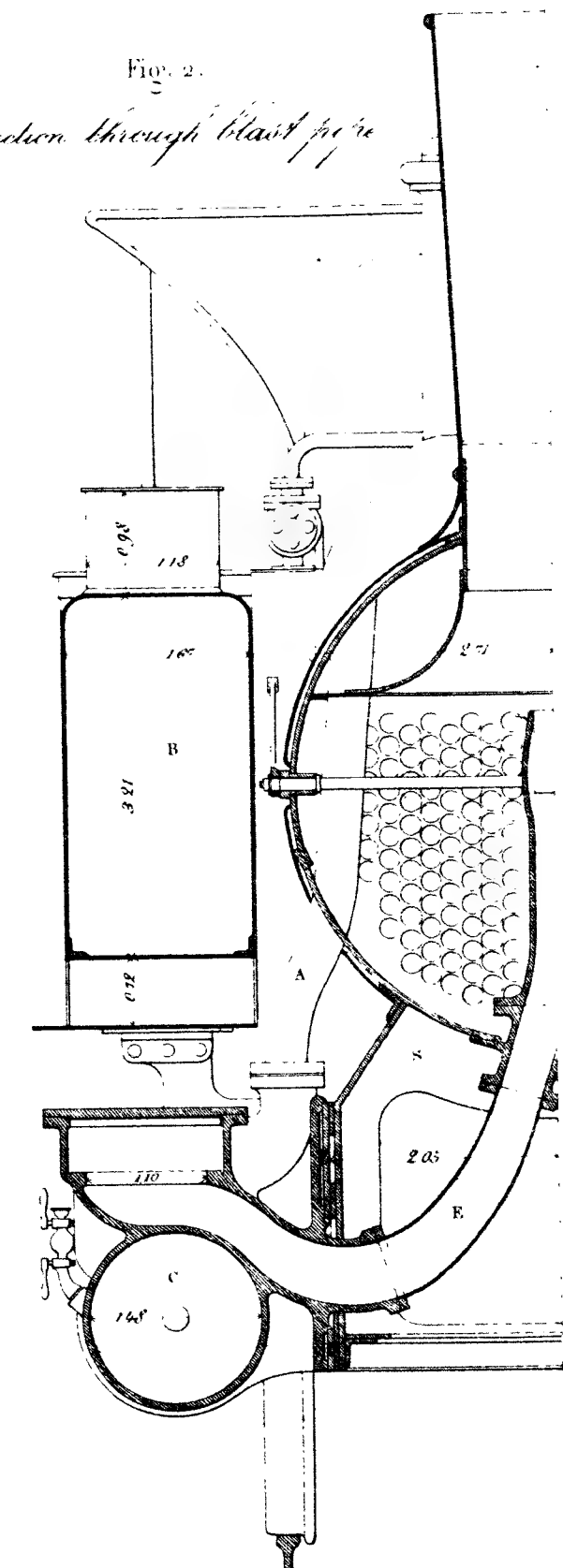
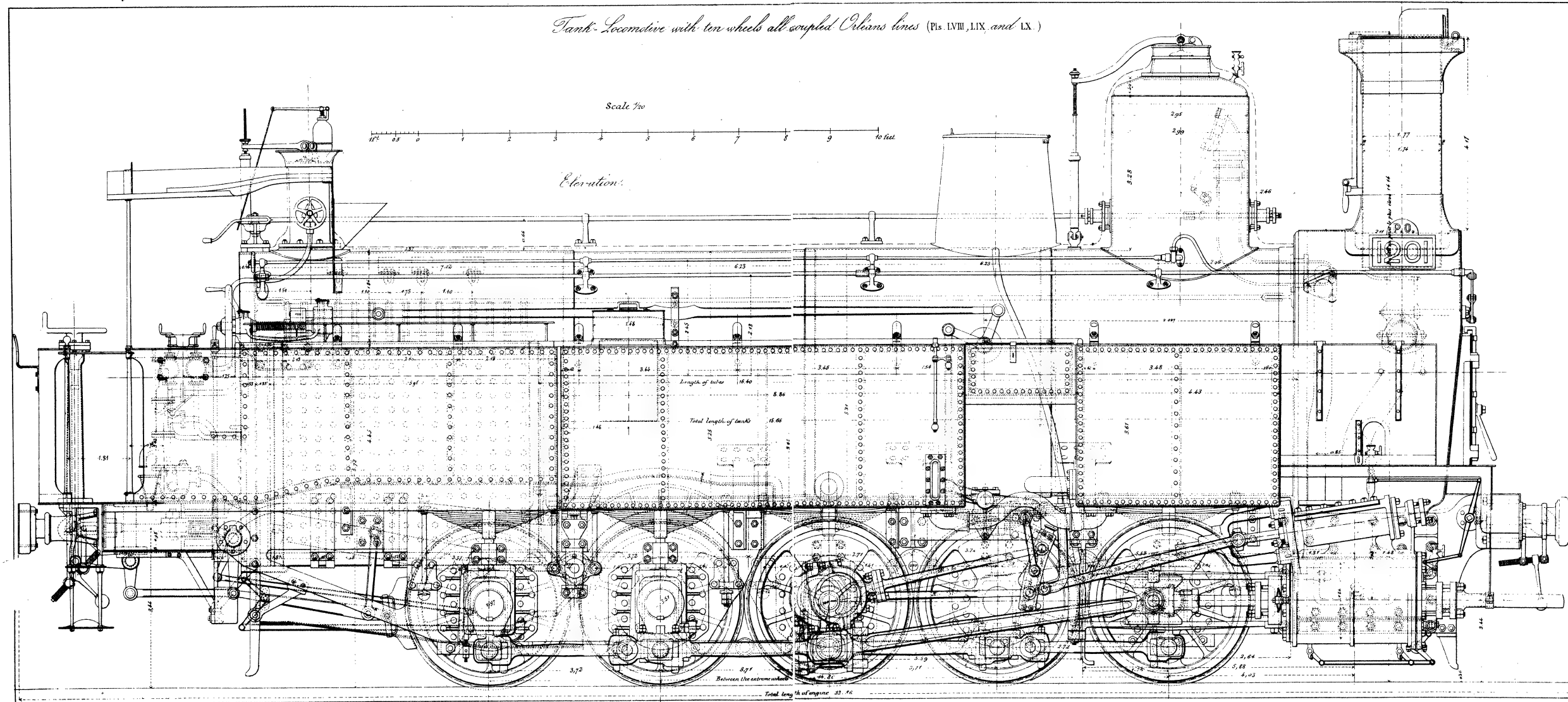


Fig. 2.  
*1/2 section through blast pipe*









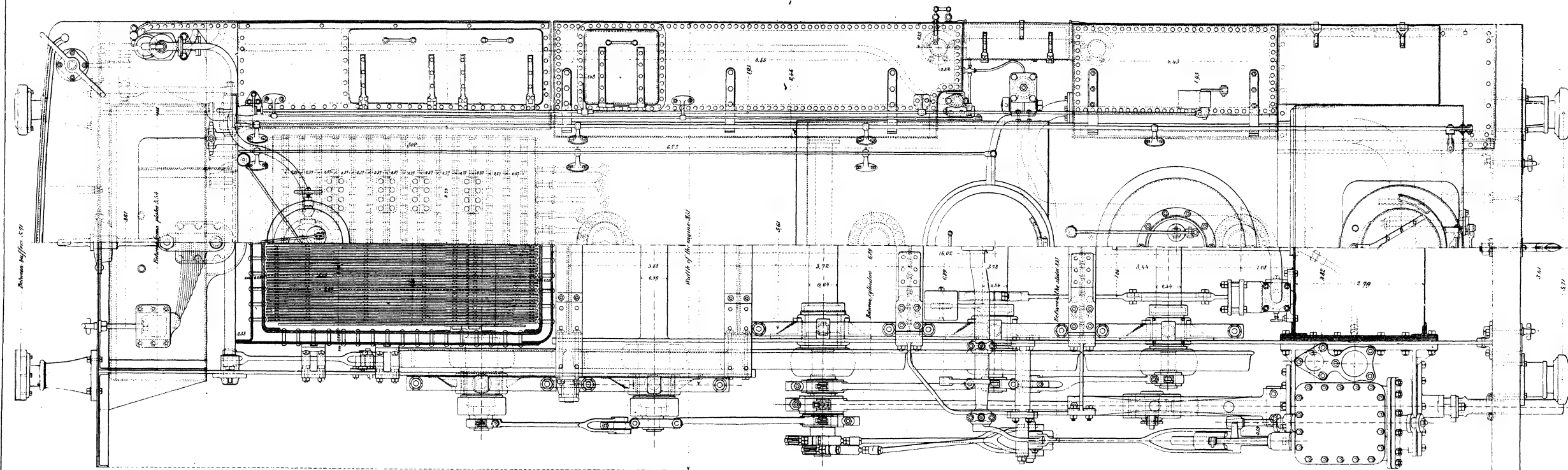


Vol II Pl. LIX

*Tank locomotives with ten wheels all coupled, Orleans lines.*

(Pls LVIII, LIX and LX.)

*Plan.*



Scale  $\frac{1}{20}$

10 Feet



*Tank Locomotive with ten wheels all coupled Orleans lines (Pls LVIII, LIX and LX)*

Fig. 1.  
*1/2 Section through  
the firebox.*

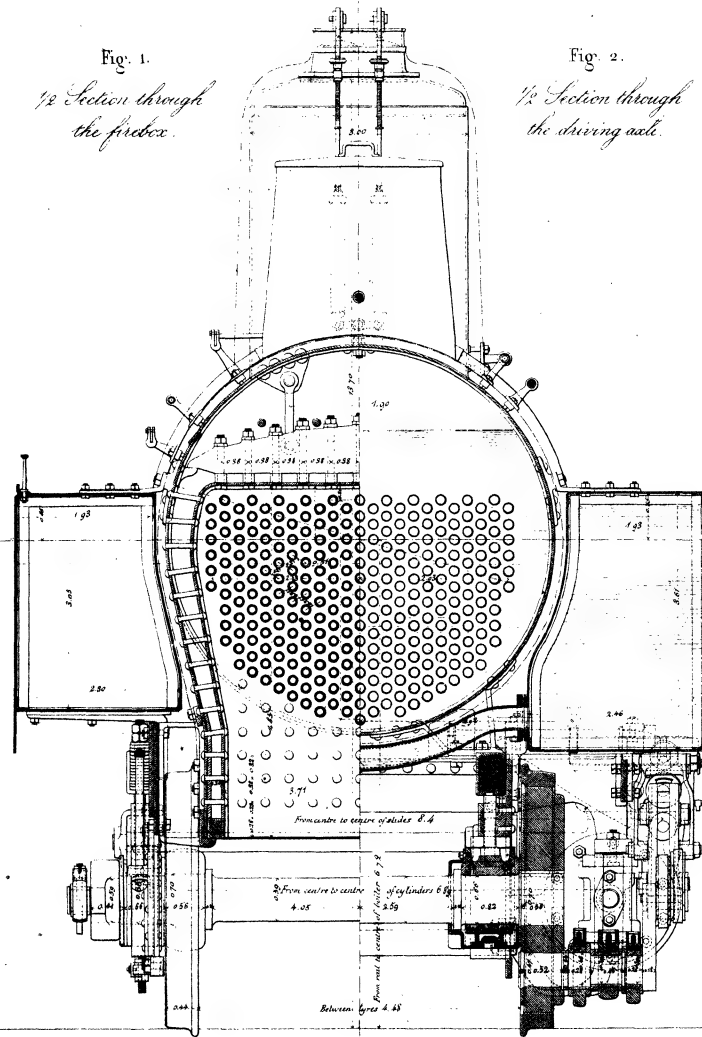


Fig. 2.  
*1/2 Section through  
the driving axle.*

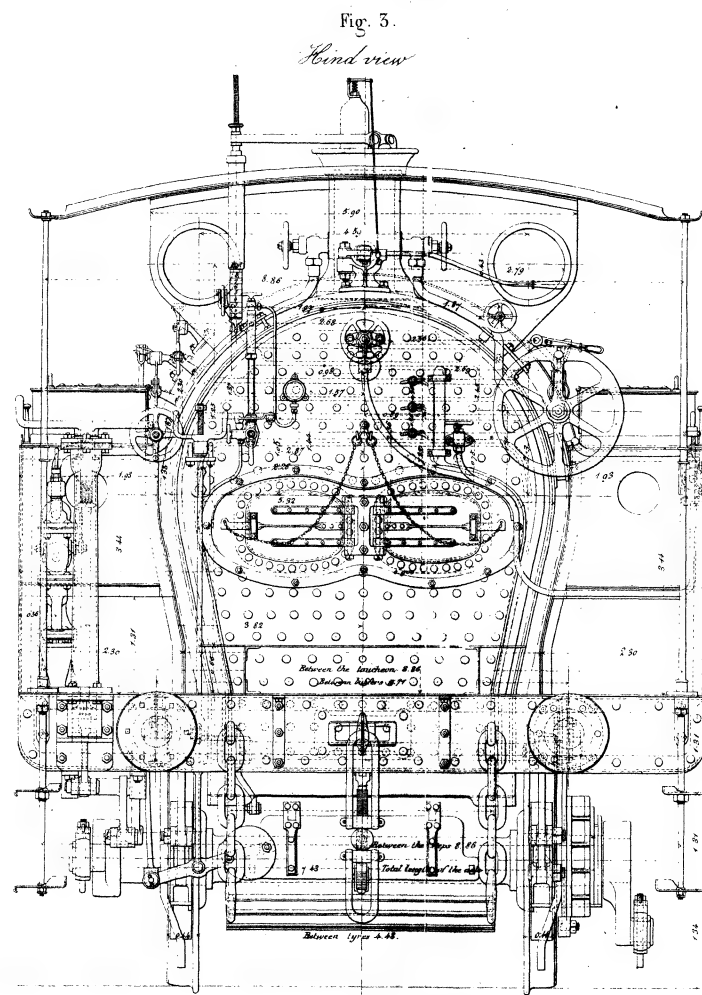
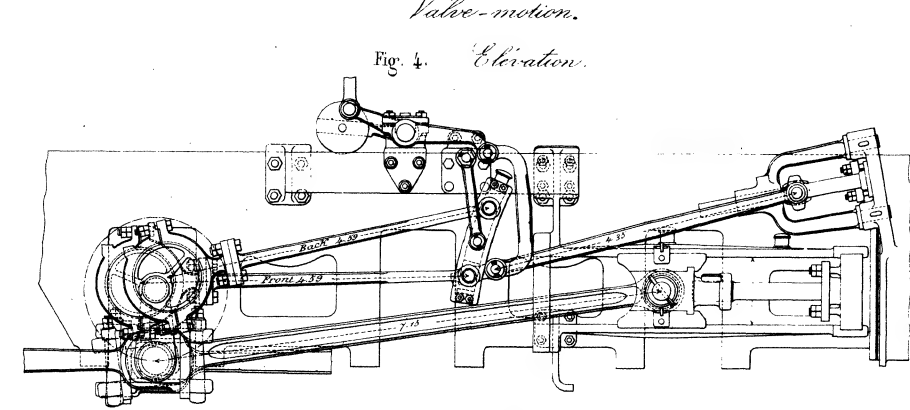


Fig. 3.  
*End view*



*Valve-motion.*

Fig. 4. *Elevation.*

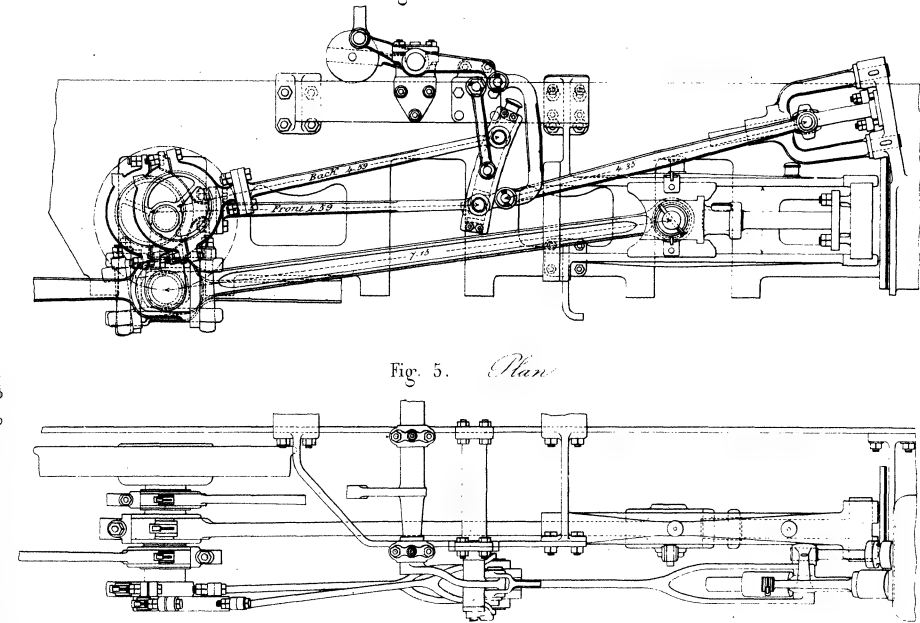
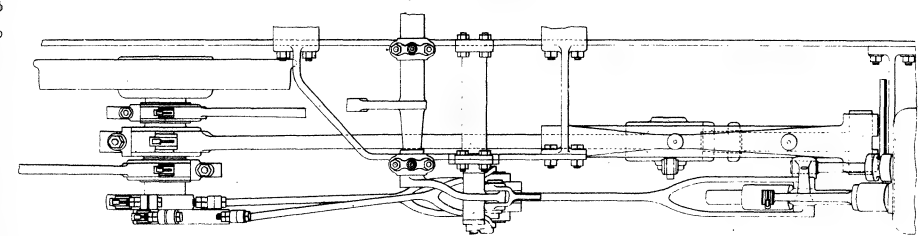


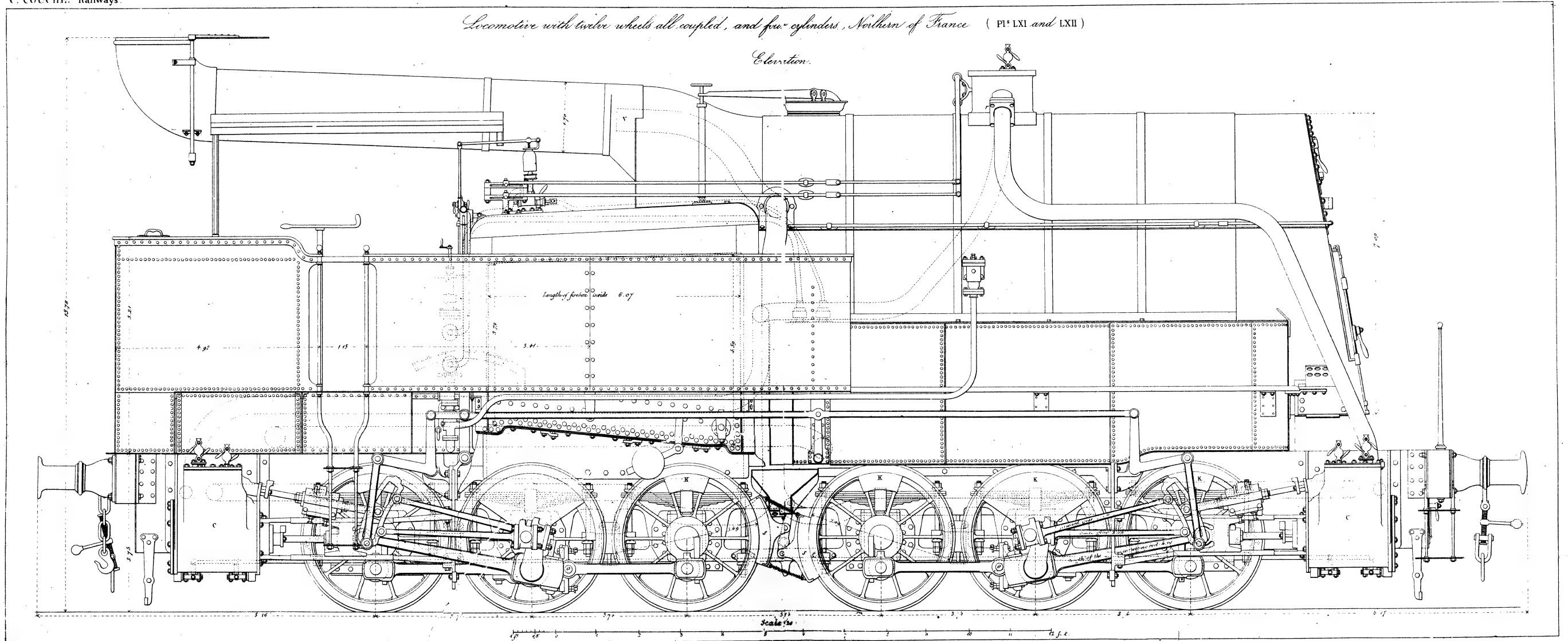
Fig. 5. *Plan*



Scale 1/20



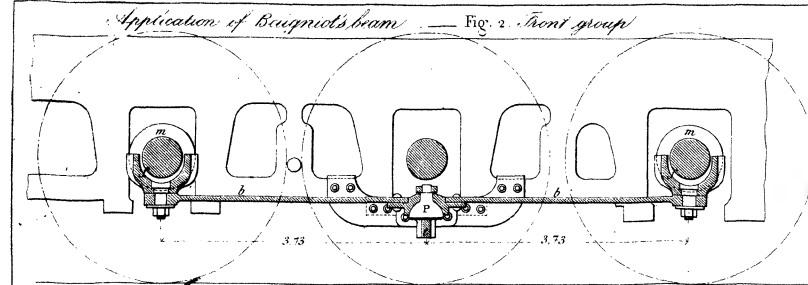








TWELVE WHEELED LOCOMOTIVES ALL COUPLED



*Locomotive with twelve wheels all coupled and four cylinders*  
*Northern of France (P<sup>re</sup> LXI and LXII)*

Fig. 3. *Plan showing the position of the beams.*

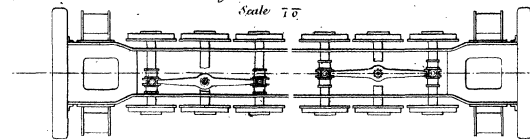
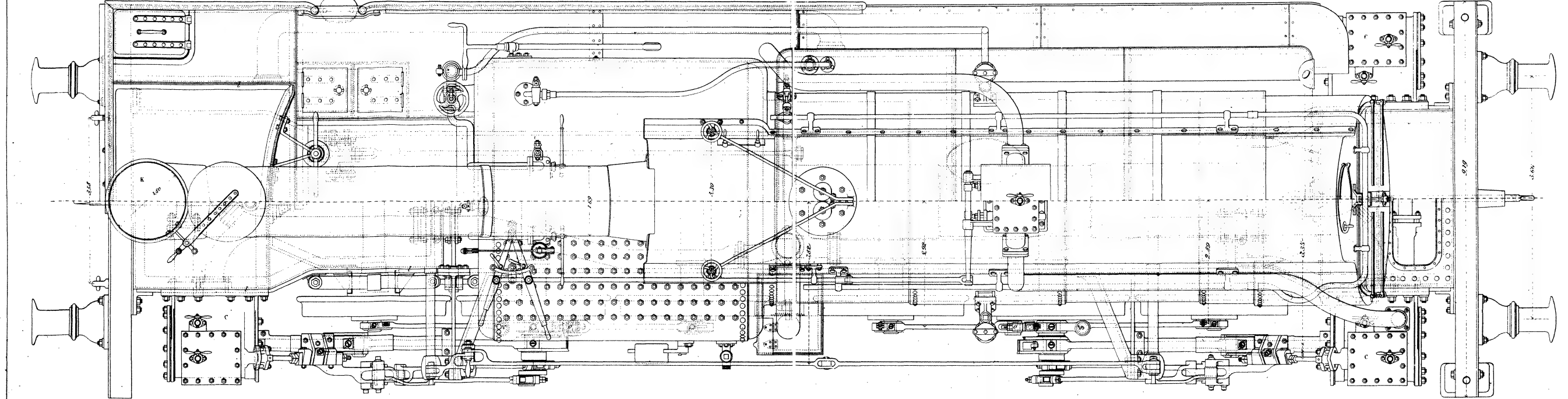
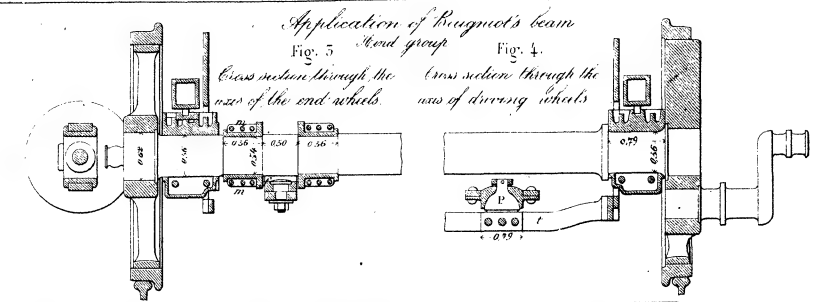
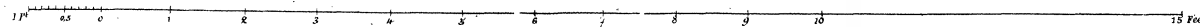


Fig. 4. *Plan at different heights*

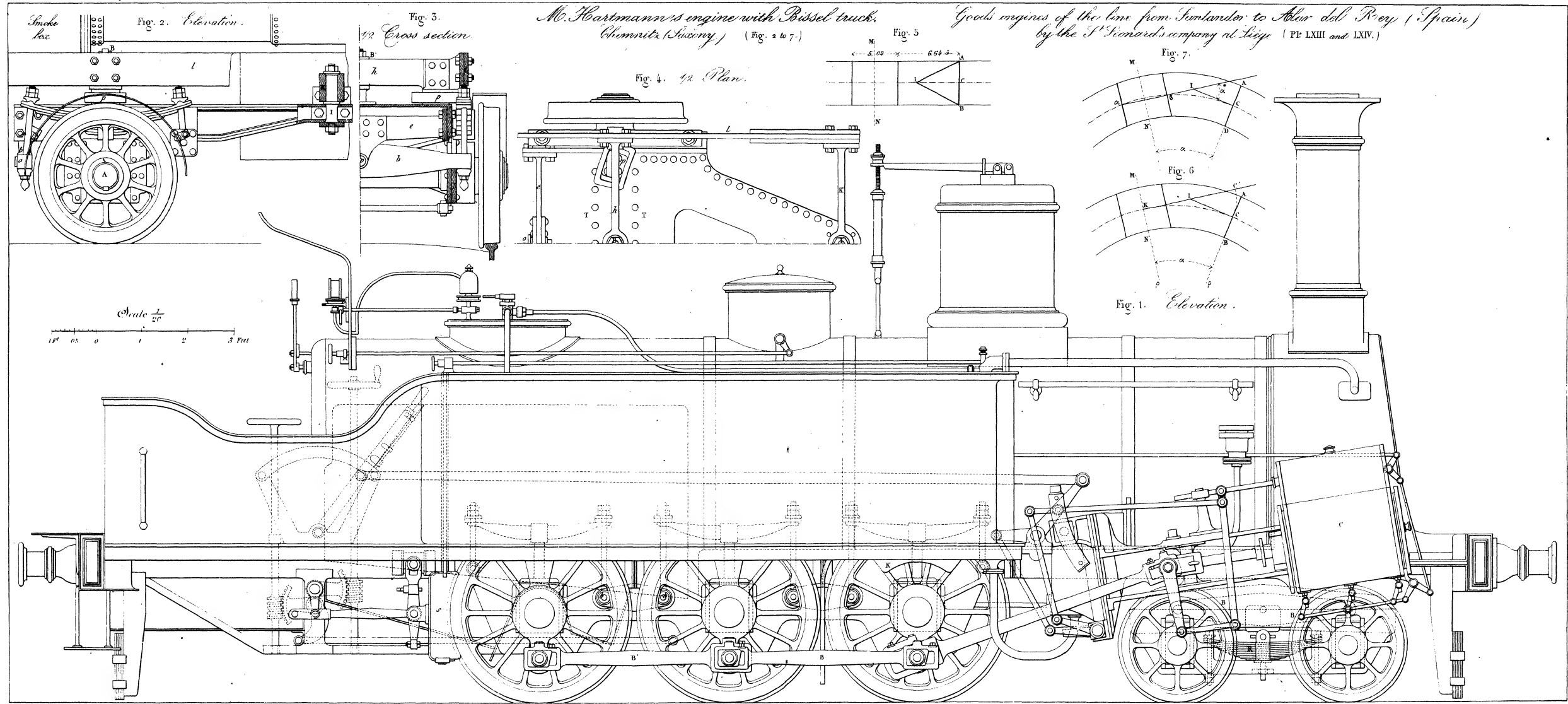


Scale  $\frac{1}{20}$





# TANK-LOCOMOTIVES WITH BOGIE TRUCK.





*Goods engine of the line from Santander to Alar del Rey (Spain)*

*S. Leonard's company at Liège (Pl. LXIII and LXIV.)*

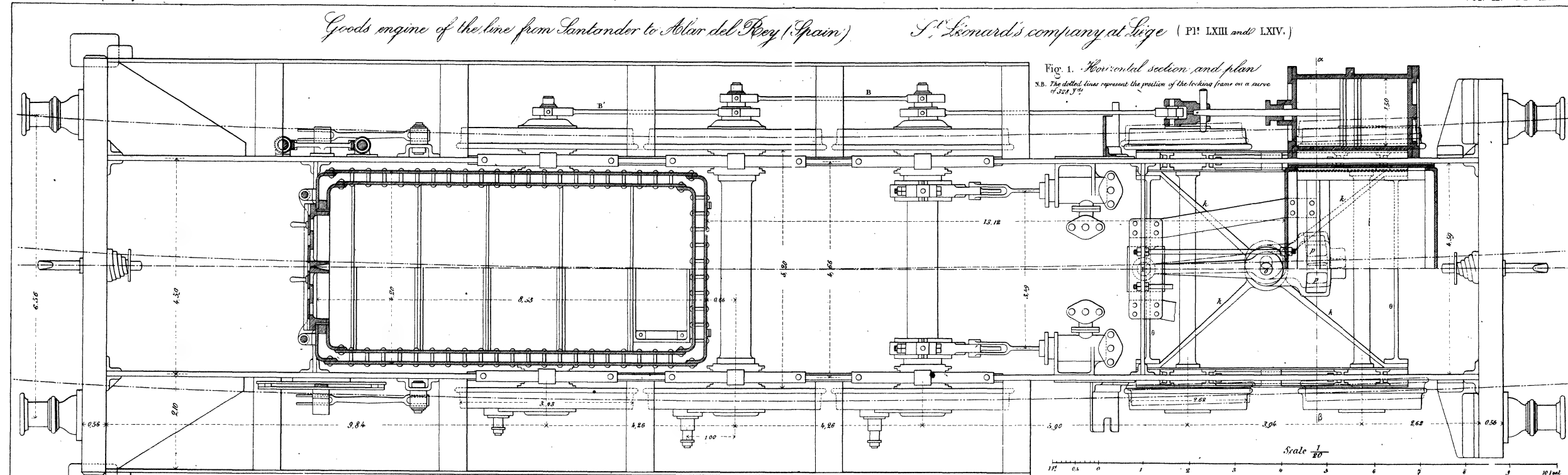


Fig. 2. Longitudinal section of the front frame

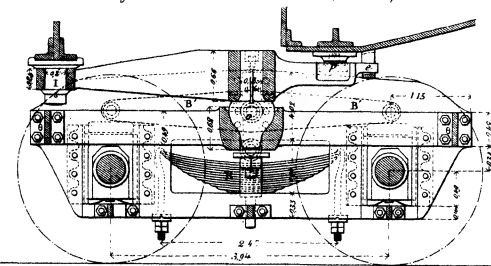


Fig. 3. Plan of the locking frame

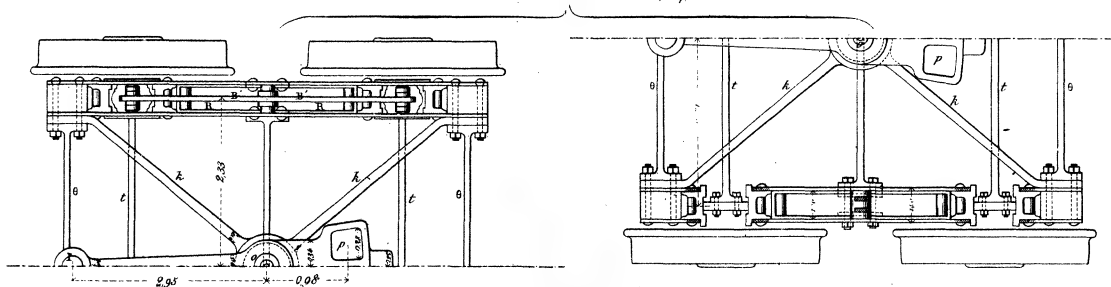
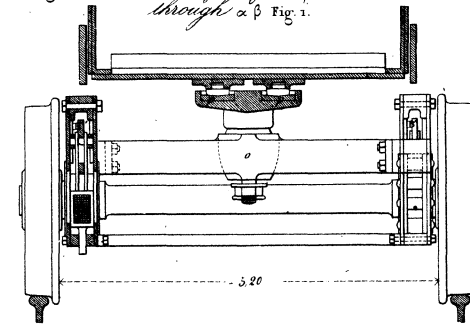


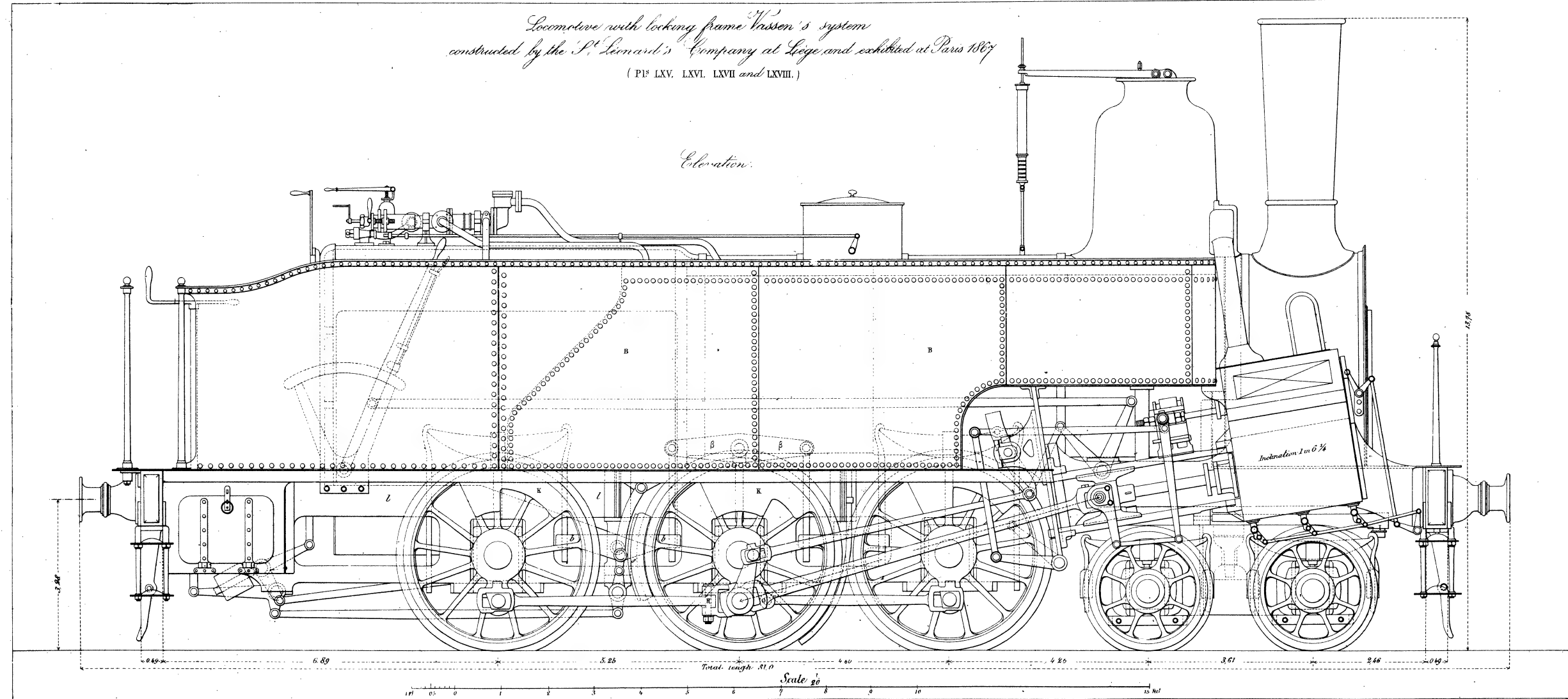
Fig. 4. Cross section of the front frame through  $\alpha\beta$  Fig. 1.





*Locomotive with locking frame Tassen's system  
constructed by the S<sup>t</sup> Leonard's Company at Liège and exhibited at Paris 1867*  
(Pls LXV. LXVI. LXVII and LXVIII.)

*Elevation.*



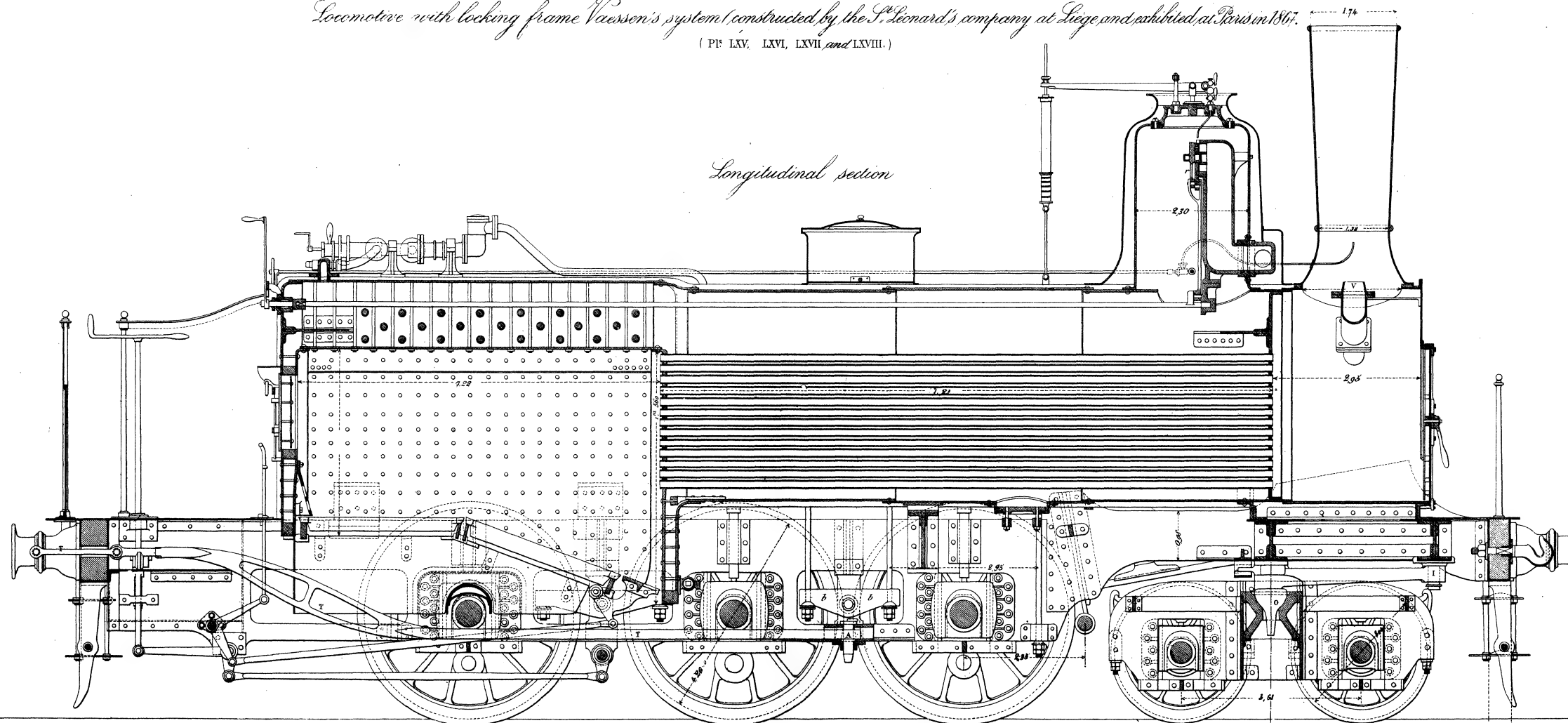




*Locomotive with locking frame Vaessen's system (constructed by the S<sup>t</sup> Leonard's company at Liege and exhibited at Paris in 1867.*

( Pls LXV, LXVI, LXVII and LXVIII. )

*Longitudinal section*



Scale  $\frac{1}{50}$

15 Pds

6,07

4,26

0,49

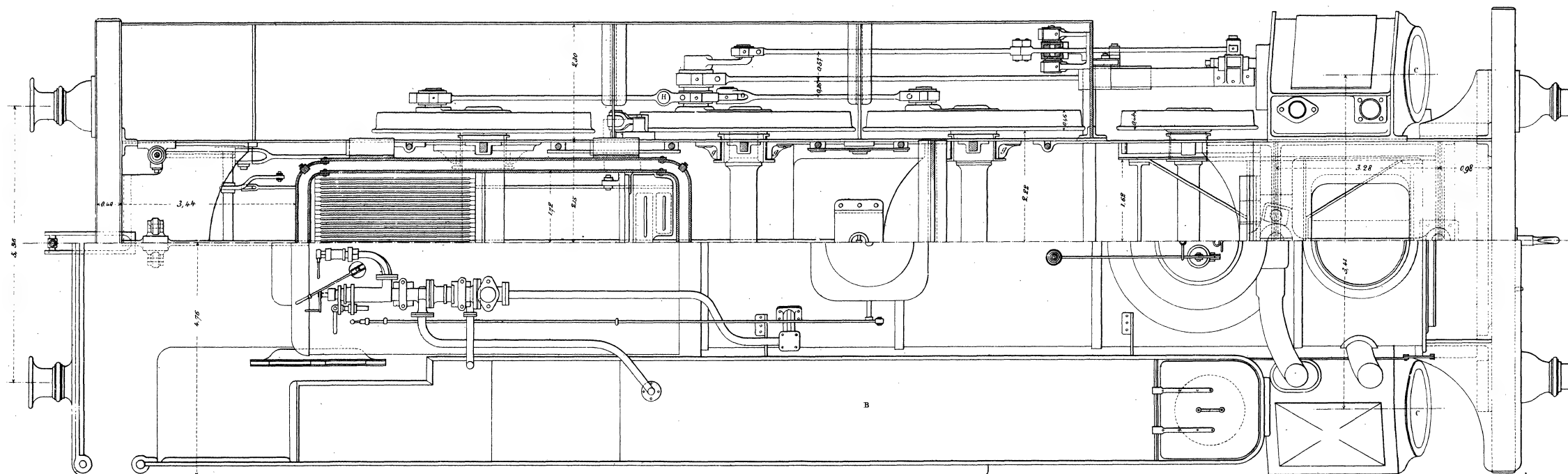
*Terminé par M. J. C.*



*Locomotive with locking frame Vaesson's system (constructed by the St. Leonard's company at Reige exhibited at Paris in 1867)*

Pl<sup>s</sup> LXV LXVI, LXVII and LXVIII )

*Plan and horizontal section*



Scale  $\frac{1}{20}$

15 feet



*Locomotive with locking frame Vaessen's system  
constructed by the S.<sup>t</sup> Leonard's Company at Liege and exhibited at Paris, in 1867.*  
(Pls LXV, LXVI, LXVII, and LXVIII.)

Scale  $\frac{1}{20}$



Fig. 1.  
1/2 Hind view

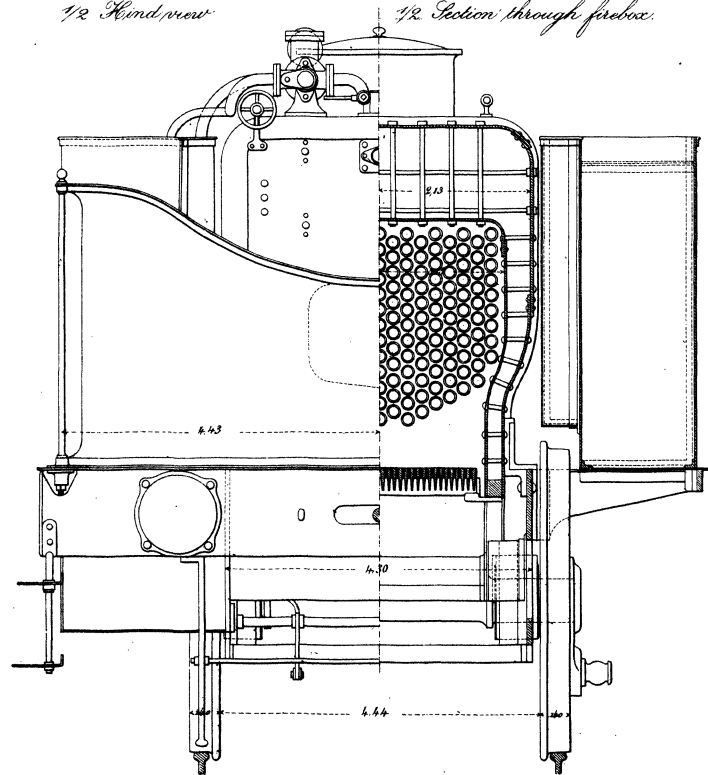


Fig. 3.

*1/2. Section through Blast-pipe*

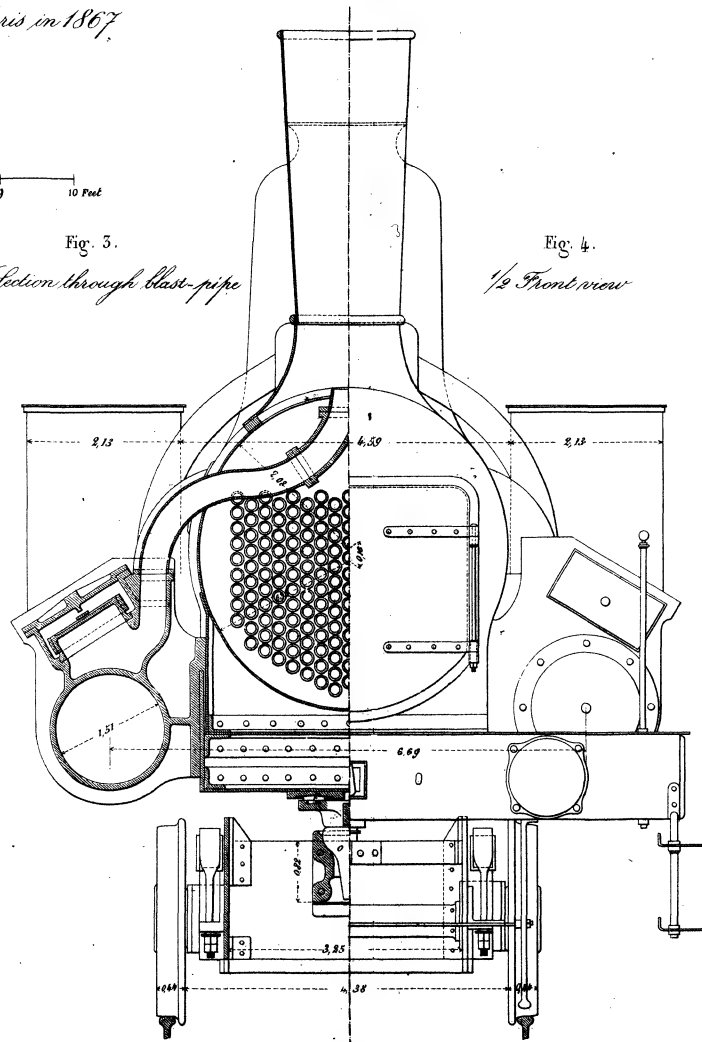


Fig. 5. *Hand-wheel axle box*..... (Fig. 5, 6 and 7.)

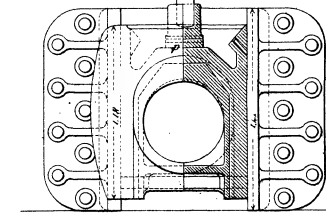


Fig. 7. Horizontal section

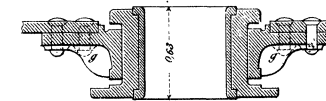
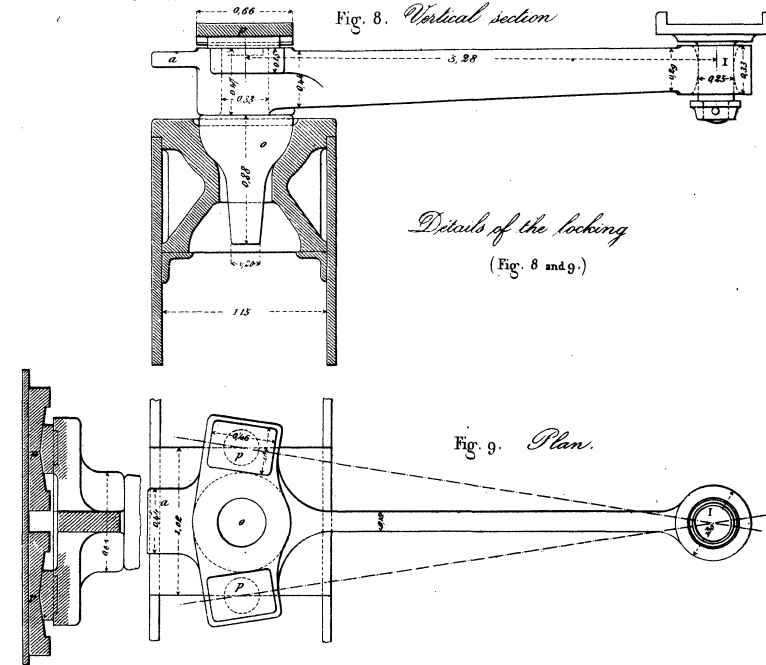


Fig. 8. *Vertical section*

*Details of the locking*  
(Fig. 8 and 9.)



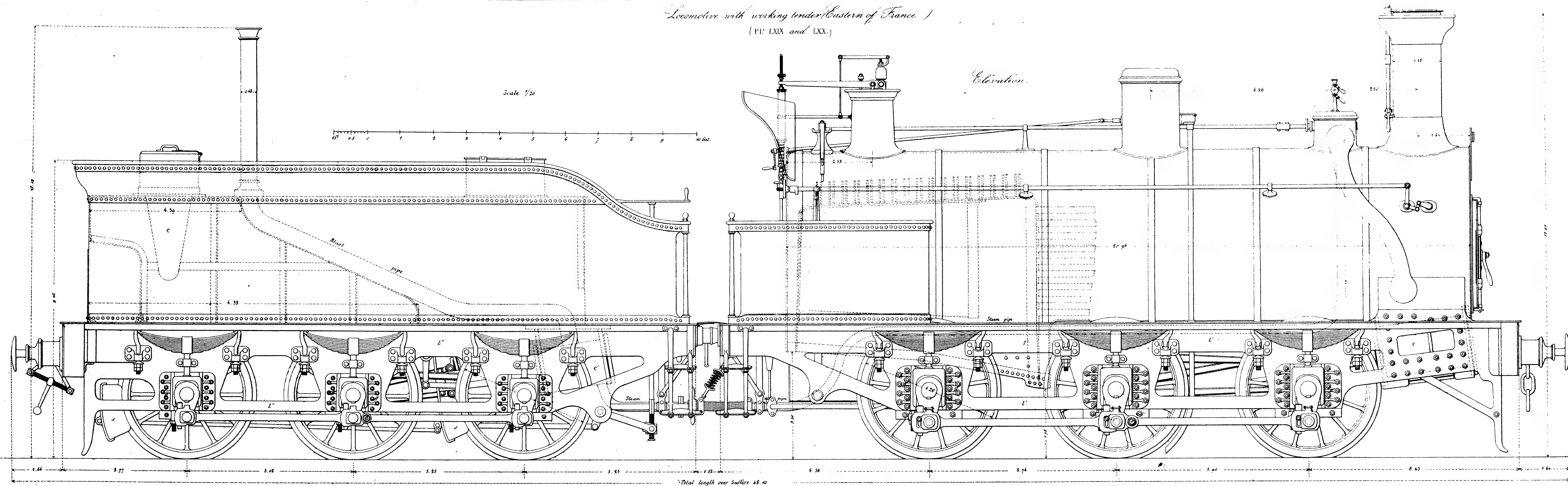


*Locomotive with working tender (Eastern of France)*  
(Pl. LXIX and LXX.)

Scale  $\frac{1}{20}$

10 feet

*Elevation.*







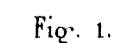
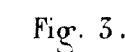
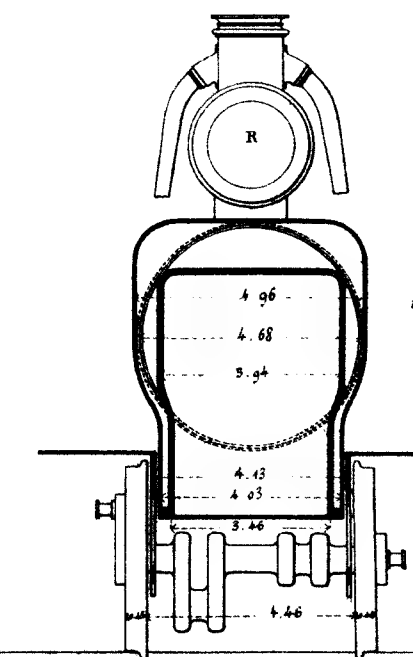


Fig. 2. *Elevation.*



Cross section  
through firebox



Scale Fig. 1 = 20

Scale Fig's 2 and 3 1/50

*Le maître del et se*

*Locomotive with working tender Central Belgian  
(Louvain shops)  
(Fig.\* 2 and 3.)*

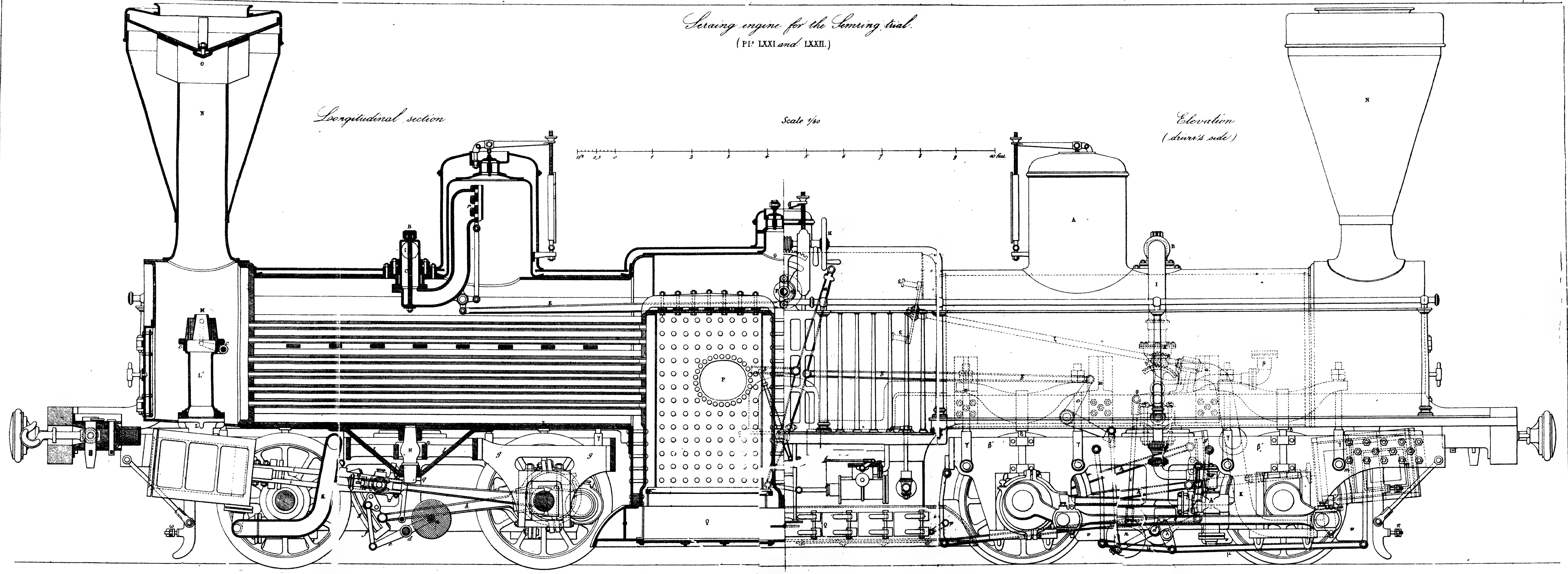


*Straing engine for the Semring trial.*  
(Pl. LXXI and LXXII.)

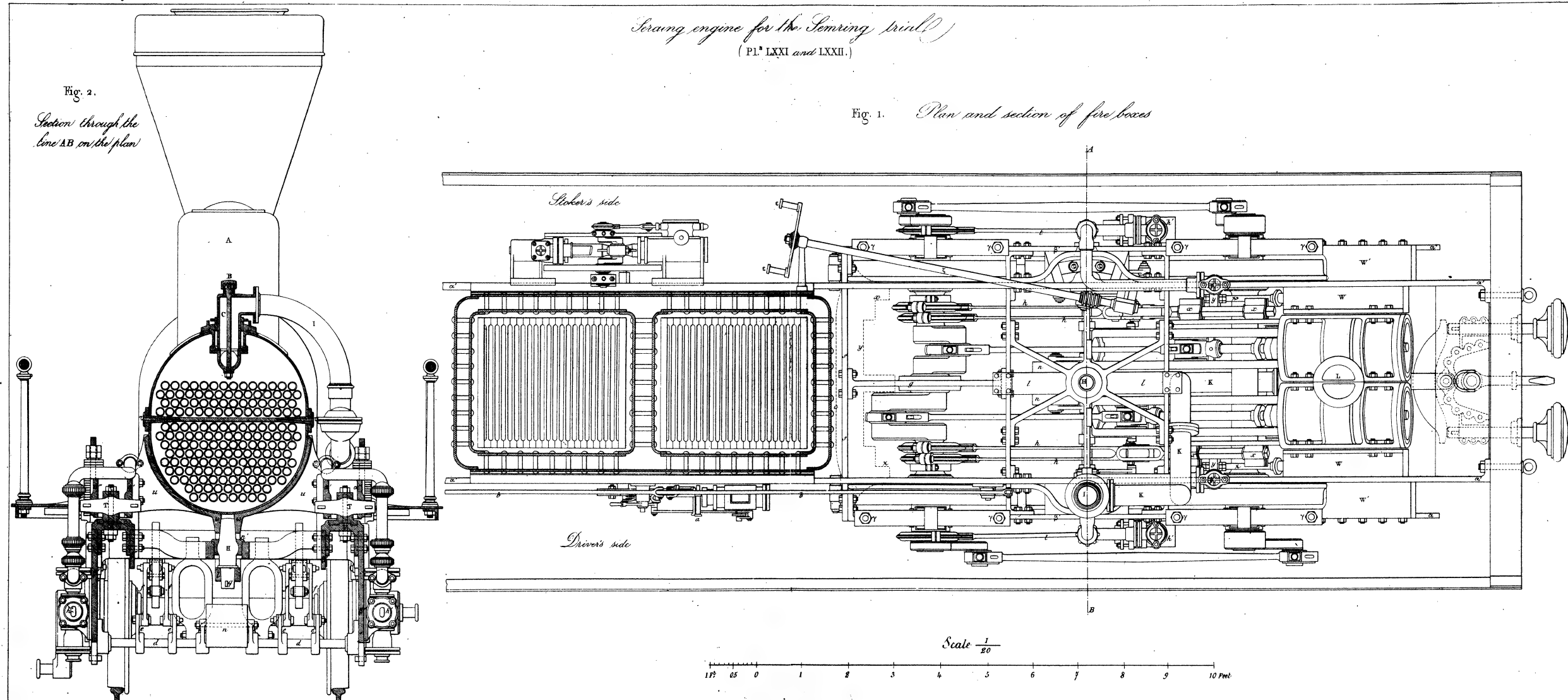
*Longitudinal section*

*Scale 1/50*

*Elevation  
(driver's side)*



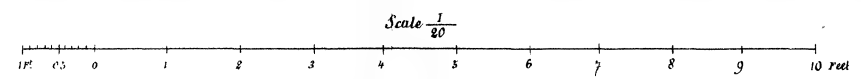
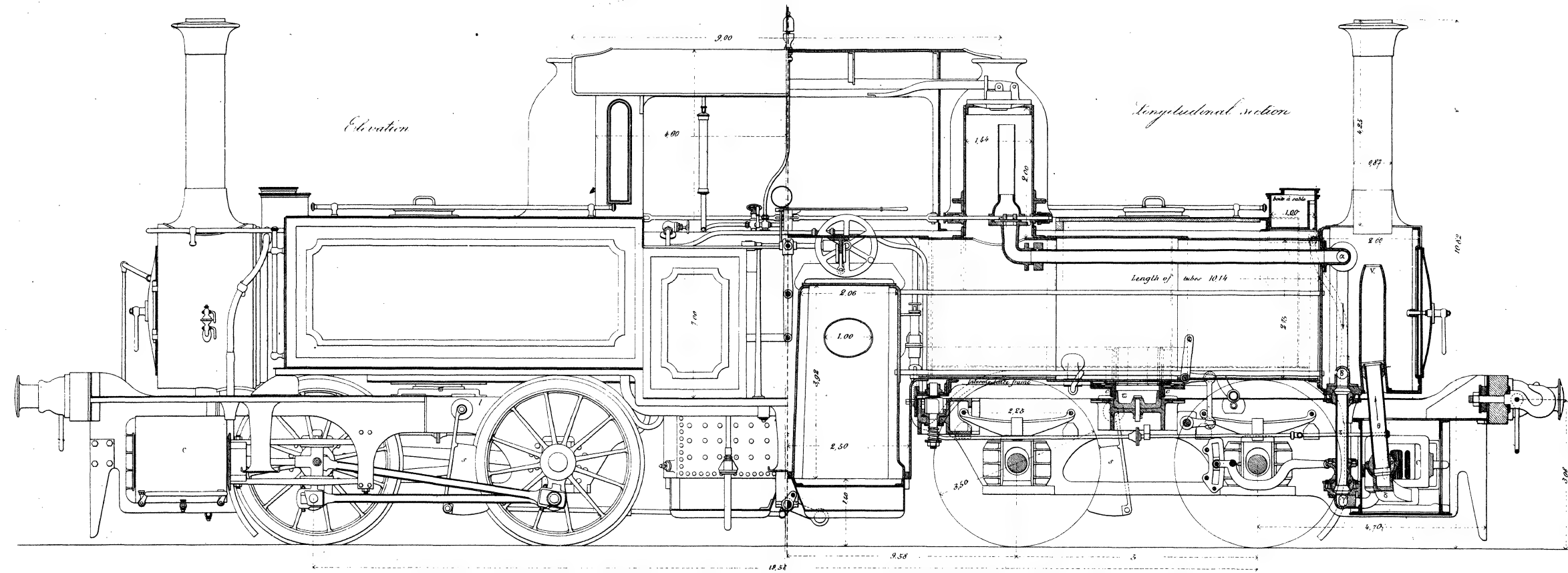






LOCOMOTIVES WITH TWO DRIVING BOGIE TRUCKS.

*Engine on Fairlie's system for the line from Narsjö to Oscarshamn (Sweden)*  
(Pl. LXXIII and LXXIV.)

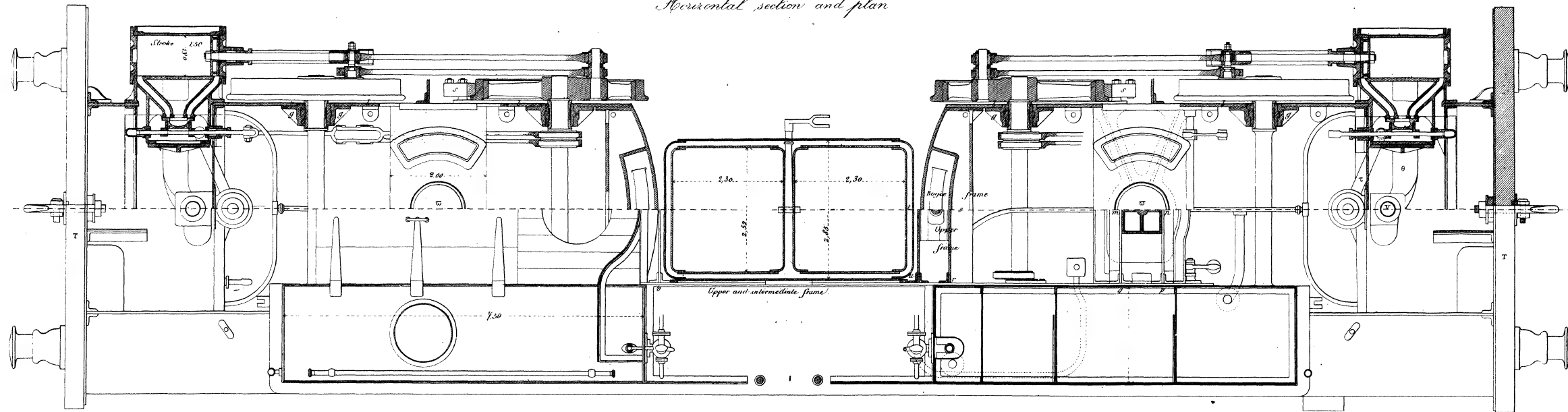






*Engine on Fairlie's system for the line from Nasjö to Oscarshamn (Sweden)*  
(Pl. LXXIII and LXXIV.)

*Horizontal section and plan*



Scale  $\frac{1}{20}$

1 1/2 0.5 0 1 2 3 4 5 6 7 8 9 10 Feet



Vol II Pl LXXV

*Shardorf engine* (Fig<sup>s</sup> 1 to 5 and 9 and 10.)

Fig. 1. *Elevation.*

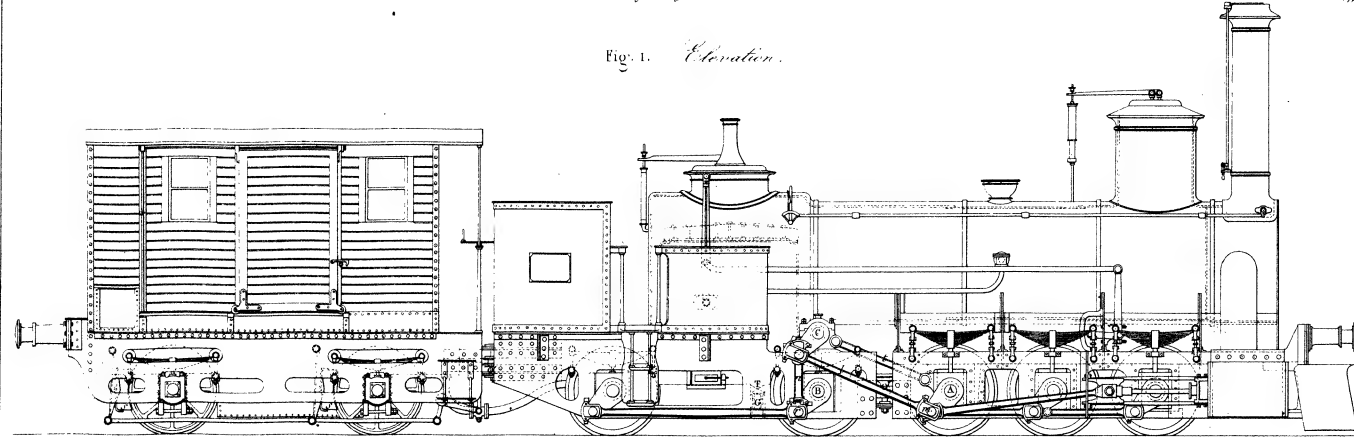


Fig. 2. *Plan and horizontal section.*

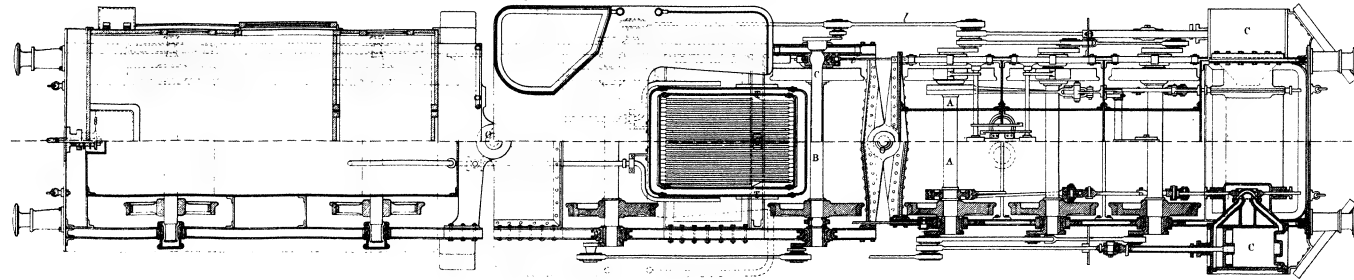


Fig. 3. *Cross section through the driving wheel.*

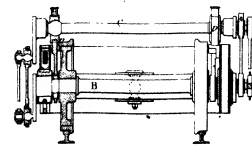


Fig. 9. *Differential way.*

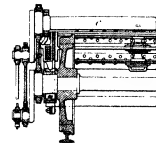


Fig. 10.

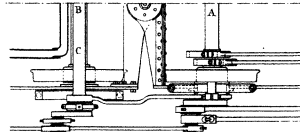


Fig. 11.

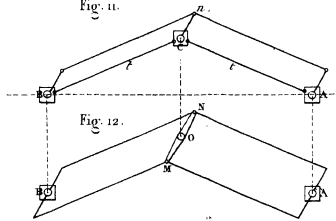


Fig. 12.

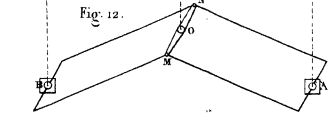
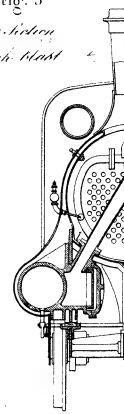
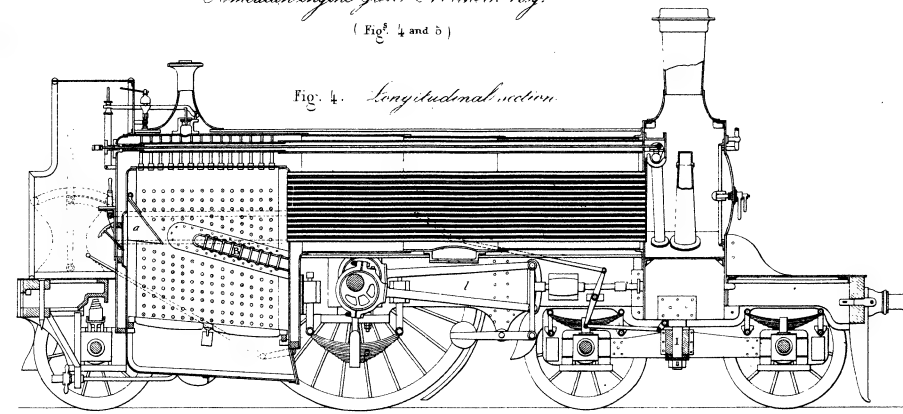


Fig. 5  
*1/2-section through blast*



*American engine Great Northern Ry.*  
(Fig<sup>s</sup> 4 and 6.)

Fig. 4. *Longitudinal section.*



*Old American engine with inside cylinders, and driving axle with simple cranks.* (Fig. 6 to 8.)

Fig. 8. *Cross section through blast pipes.*

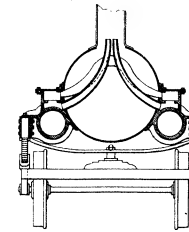


Fig. 6.

*Elevation and section through the smoke-box.*

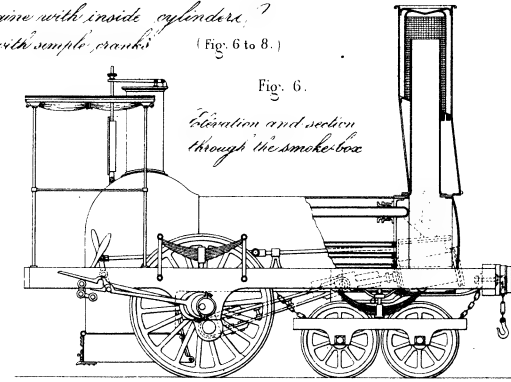
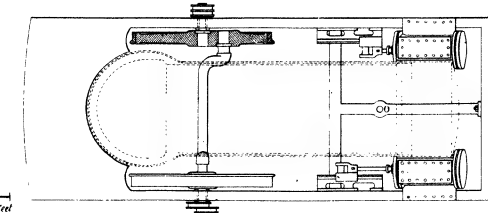


Fig. 7.

*Plan and horizontal section through the driving wheel.*



Scale  $\frac{1}{50}$

11' 0" 1 2 3 4 5 10 15 Feet



*Locomotive Wiener Neustadt, (Fig<sup>s</sup> 1 to 3.)  
(Semiing trial)*

Fig. 1. *Elevation.*

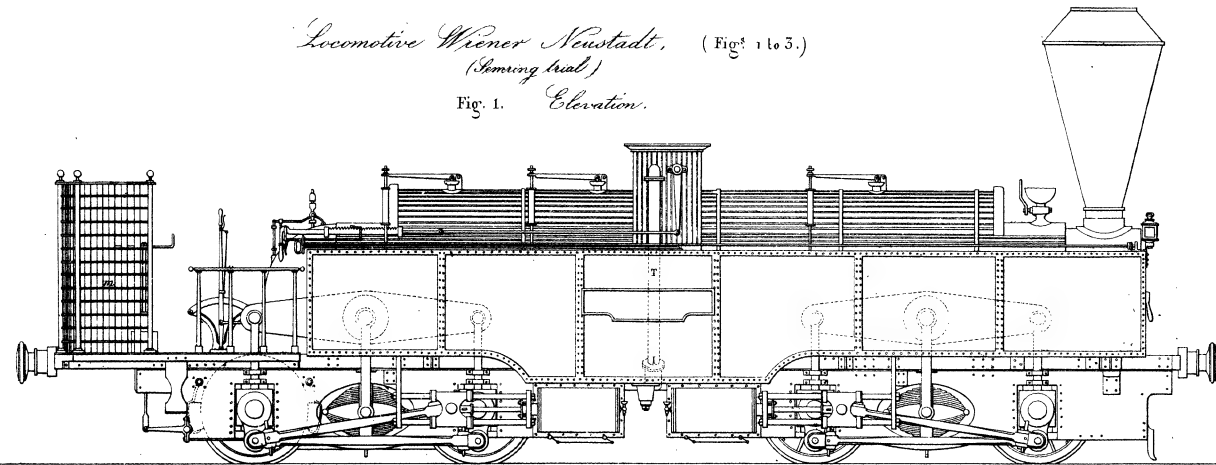


Fig. 2. *Plan*

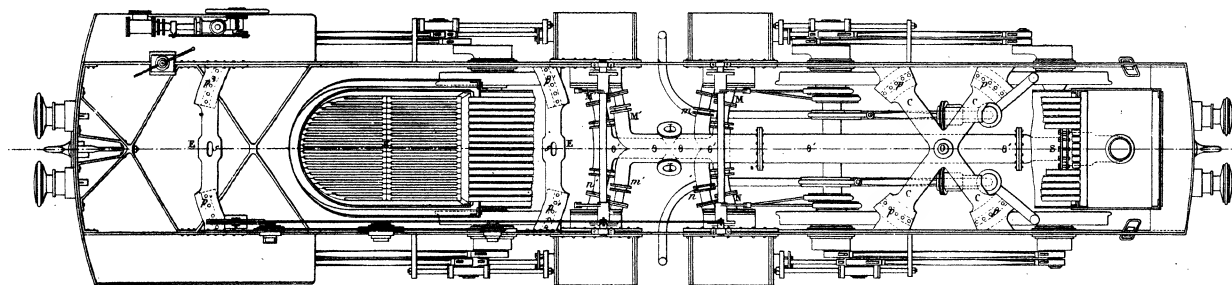
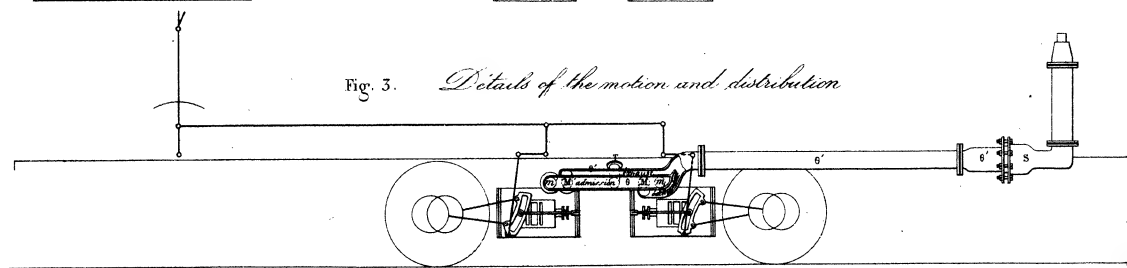


Fig. 3. *Details of the motion and distribution*



*Locomotive Bavaria, (Fig<sup>s</sup> 4 to 11.)  
(Semiing trial)*

Fig. 4. *Elevation.*

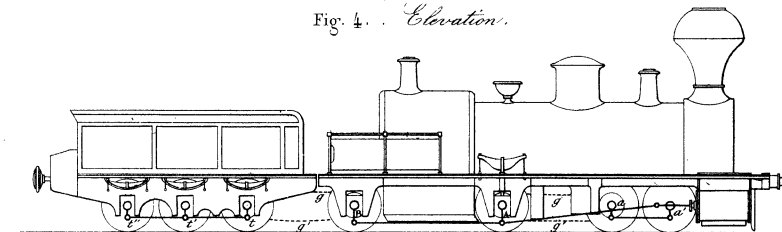


Fig. 11.

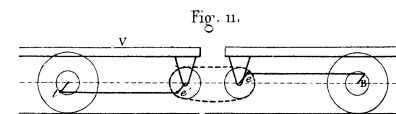


Fig. 6.

*Longitudinal section*

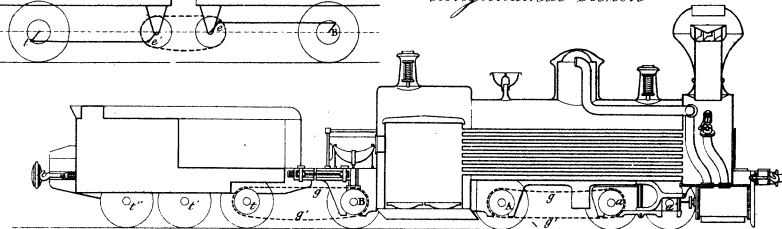


Fig. 5.

*Cross section*

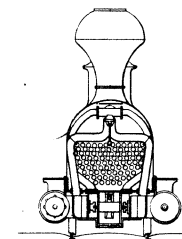
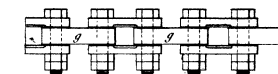


Fig. 7.

*Plan of the chain*



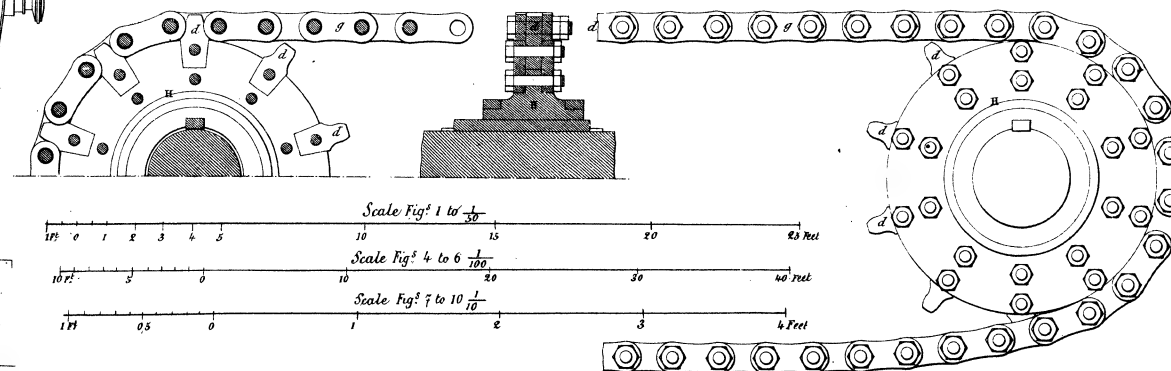
*Details of the coupling by gearing and endless chain (Fig<sup>s</sup> 7 to 10)*

Fig. 8. *Vertical section*

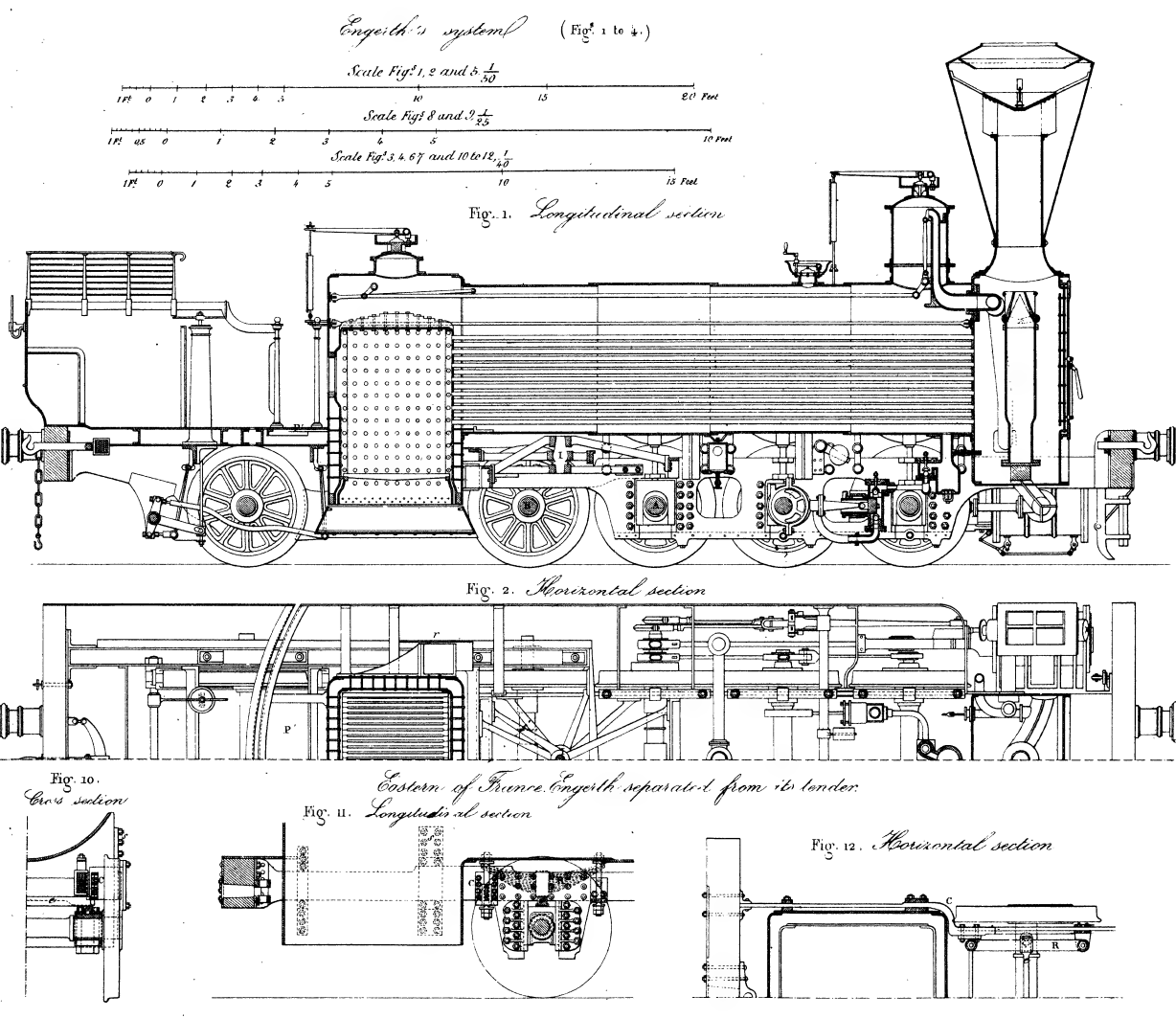
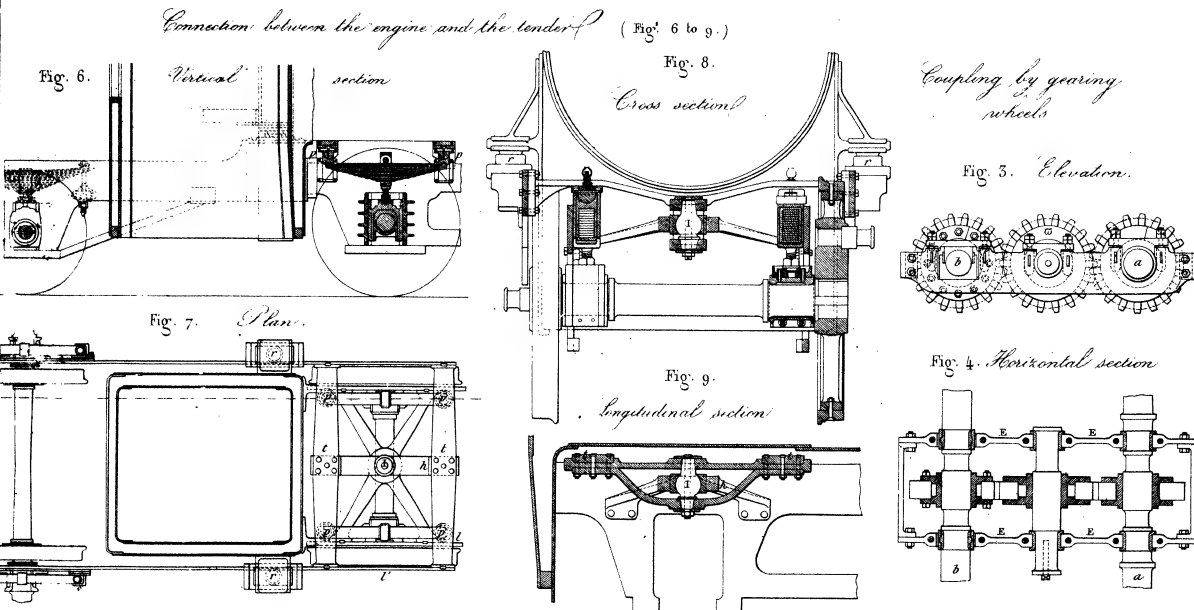
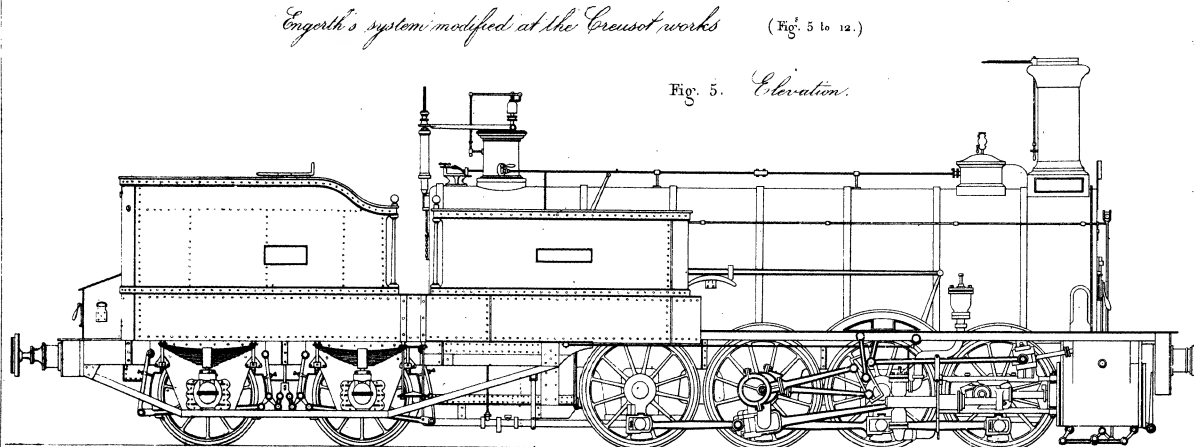
Fig. 9.

*Cross section*

Fig. 10. *Elevation.*

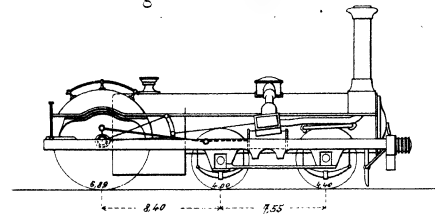




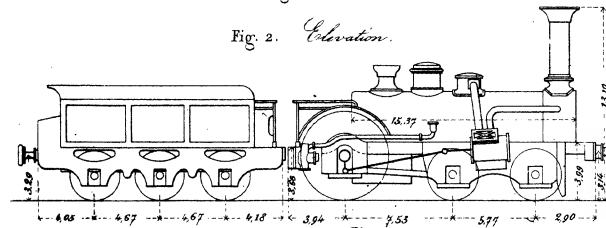
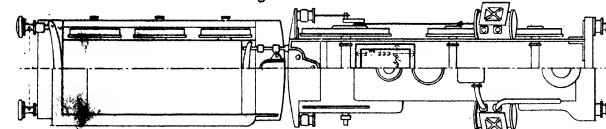
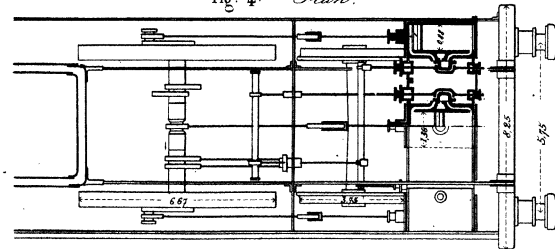
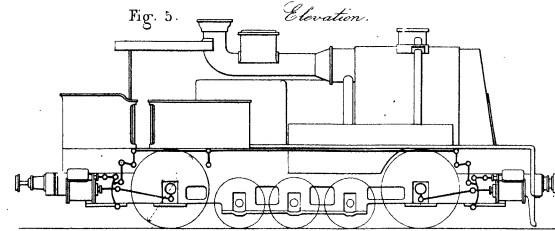
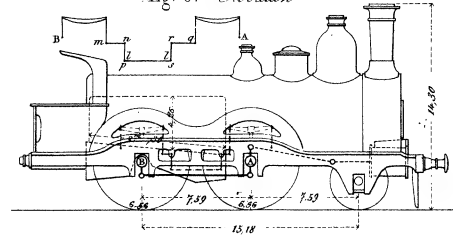




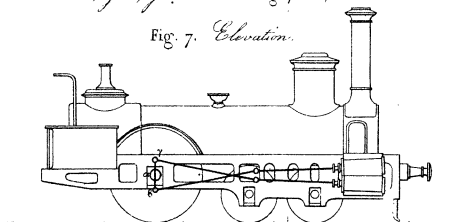
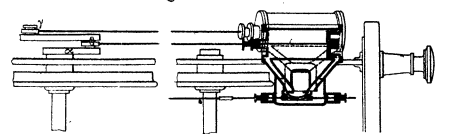


*Crampton engine (Northern)*Fig. 1. *Elevation.**Crampton engine (Denmark)*

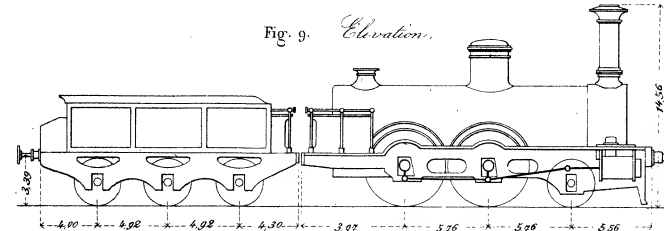
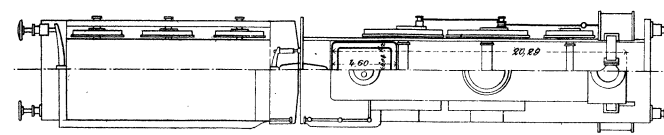
(Fig. 2 and 3)

Fig. 2. *Elevation.*Fig. 3. *Plan.**Stephenson's three cylinder engine*Fig. 4. *Plan.*Fig. 5. *Elevation.**Engine Belgian state lines*Fig. 6. *Elevation.**Hasselt's engine equilibrated by 4 cylinders.*

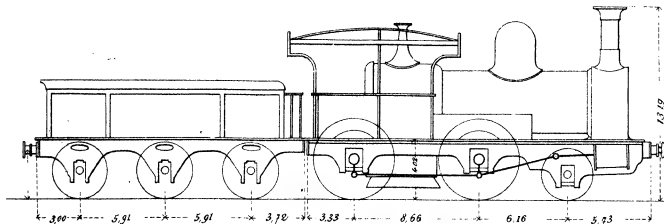
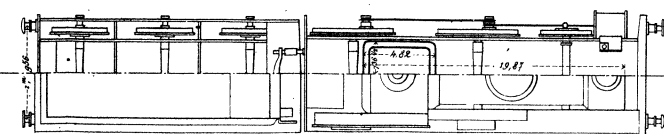
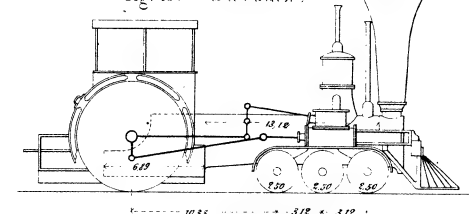
(Fig. 7 and 8.)

Fig. 7. *Elevation.*Fig. 8. *Plan.**Engine of the Leghorn lines*

(Fig. 9 and 10.)

Fig. 9. *Elevation.*Fig. 10. *Plan.**Engine East India lines*

(Fig. 11 and 12.)

Fig. 11. *Elevation.*Fig. 12. *Plan.**Crampton engine the Morris Camden and Amboy line (United States)*Fig. 13. *Elevation.**Engine Prussian railway (Crausoff)*

(Fig. 14 and 15.)

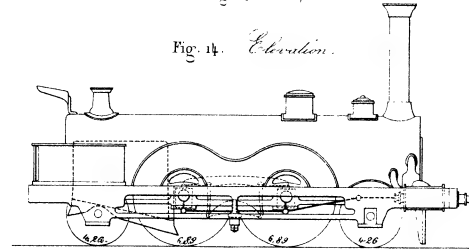
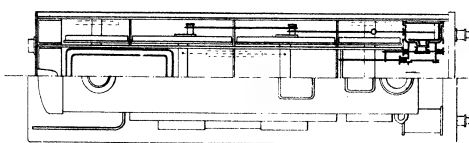
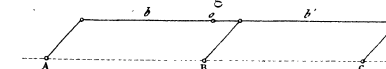
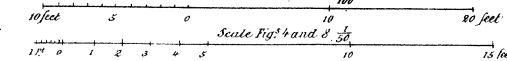
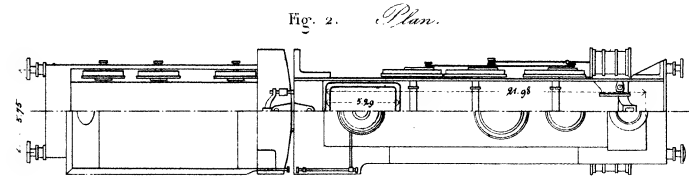
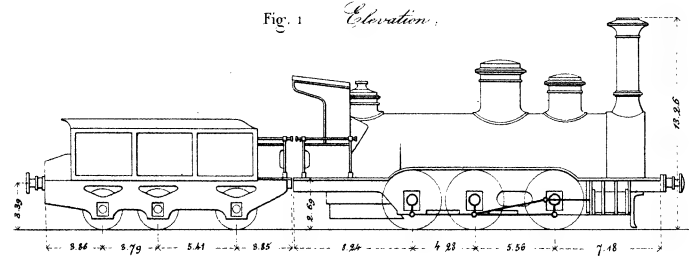
Fig. 14. *Elevation.*Fig. 15. *Plan.*

Fig. 16.

Scale Fig. 1 to 3, 5 to 7 and 9  $\frac{1}{100}$ 

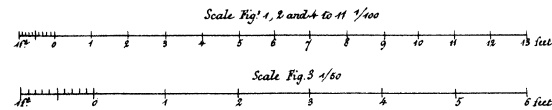
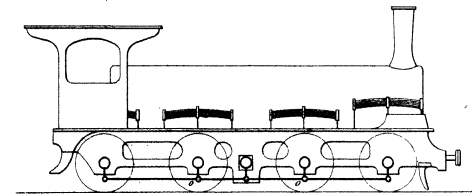


*Goods Engine. (Württemberg)*  
(Fig<sup>s</sup> 1 and 2)

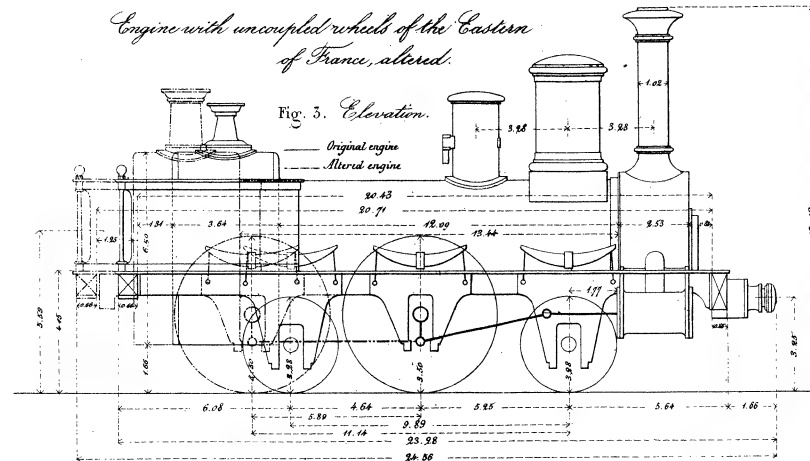


*Engine with separate driving shaft (East Indies)*  
(Cudd and Rohilhand Railways)

Fig. 6. *Elevation.*

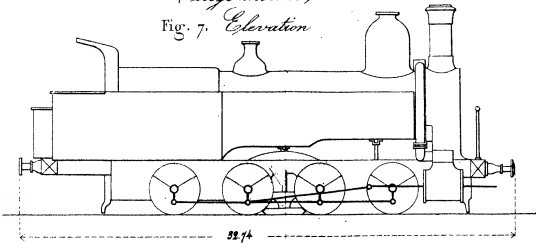


*Engine with uncoupled wheel of the Eastern of France, altered.*



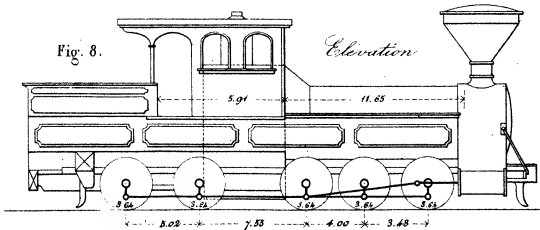
*Engines for steep inclines (Belgian State lines)*  
(Large incline)

Fig. 7. *Elevation.*



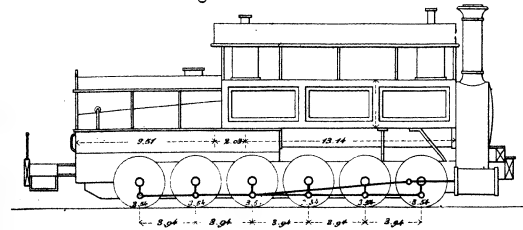
*Engine with ten wheels of the Jefferson - Little, Madison and Indianapolis line*  
(Madison incline)

Fig. 8.



*Engine with twelve wheels Mithelland's from Philadelphia to Reading.*

Fig. 9. *Elevation.*



*Goods engine of the Southern Russia lines*  
(Fig<sup>s</sup> 4 and 5.)

Fig. 4. *Elevation.*

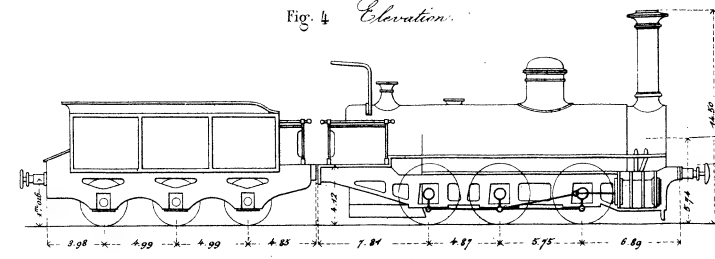
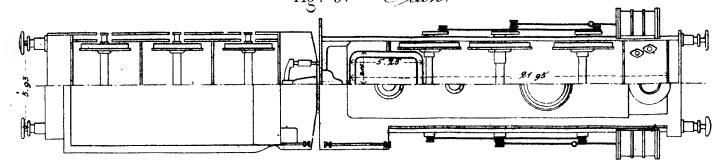


Fig. 5. *Plan.*



*Goods engine, Engestr's system*  
(Central, Paris)

(Fig<sup>s</sup> 10 and 11.)

Fig. 10. *Elevation.*

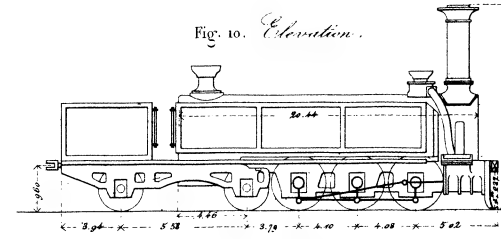
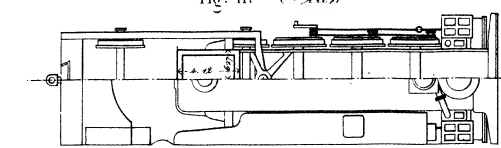


Fig. 11. *Plan.*





Bernese Railways  
(Fig<sup>s</sup> 1 and 2.)

Fig. 1. Elevation.

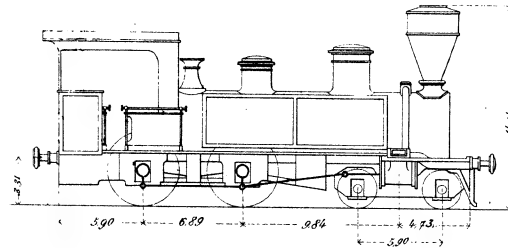
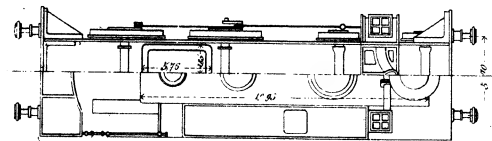
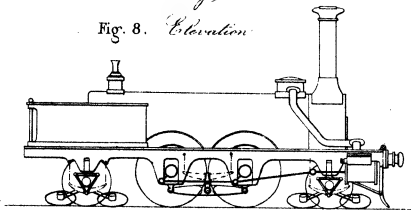


Fig. 2. Plan.



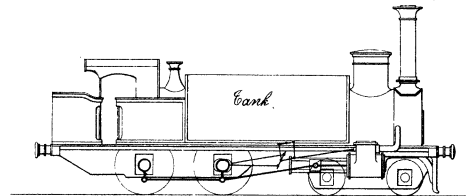
Arnoux's system  
(Paris to Creay)

Fig. 8. Elevation.



From Lausanne to Berne  
(Older shops)

Fig. 3. Elevation.



Württemberg (Fig<sup>s</sup> 9 and 10.)

Fig. 9. Elevation.

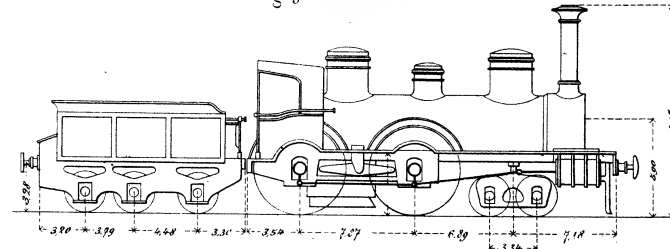
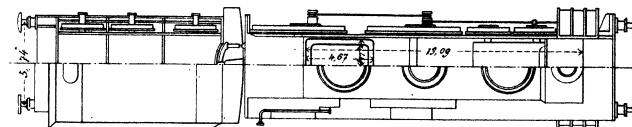


Fig. 10. Plan.



Bougniet's system  
(H<sup>e</sup> type la Rampe)  
(Fig<sup>s</sup> 4, 5 and 6.)

Fig. 4. Elevation.

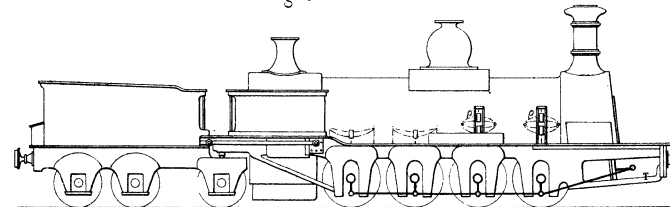


Fig. 5.

Details of the moving frame

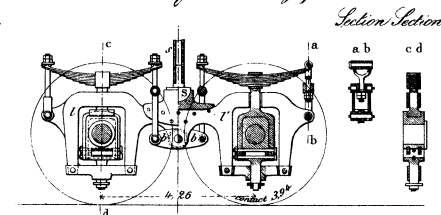
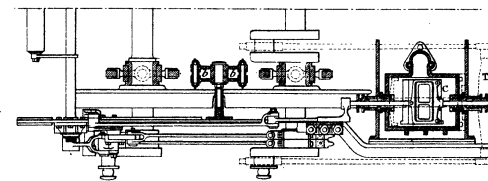


Fig. 6. Horizontal section of the beam and the cylinder



Grand's engine (United States)  
exhibited at Paris in 1867.

Fig. 7. Elevation.

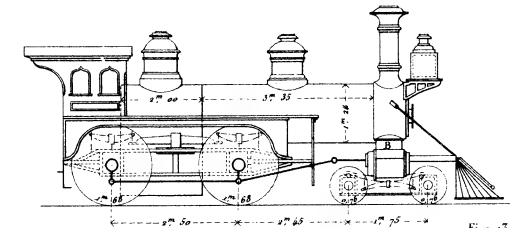
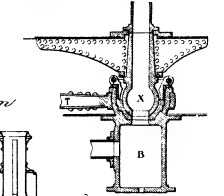


Fig. 13.

Details of the joint



Meyer's system  
(Fig<sup>s</sup> 11 to 15.)

Fig. 11. Longitudinal section

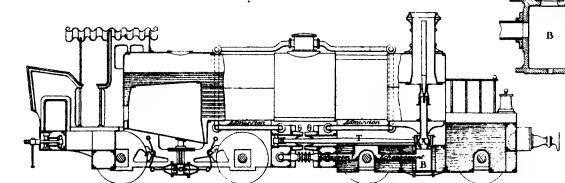
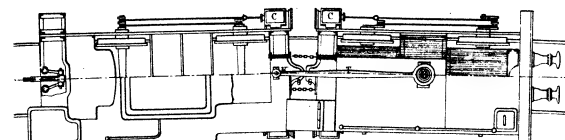


Fig. 12. Plan, horizontal section



Scale Fig<sup>s</sup> 1 to 4 and 7 to 12.  $\frac{1}{100}$

10 Feet 5 0 10 20 30 40 50 60 Feet

Scale Fig<sup>s</sup> 5 and 6.  $\frac{1}{50}$

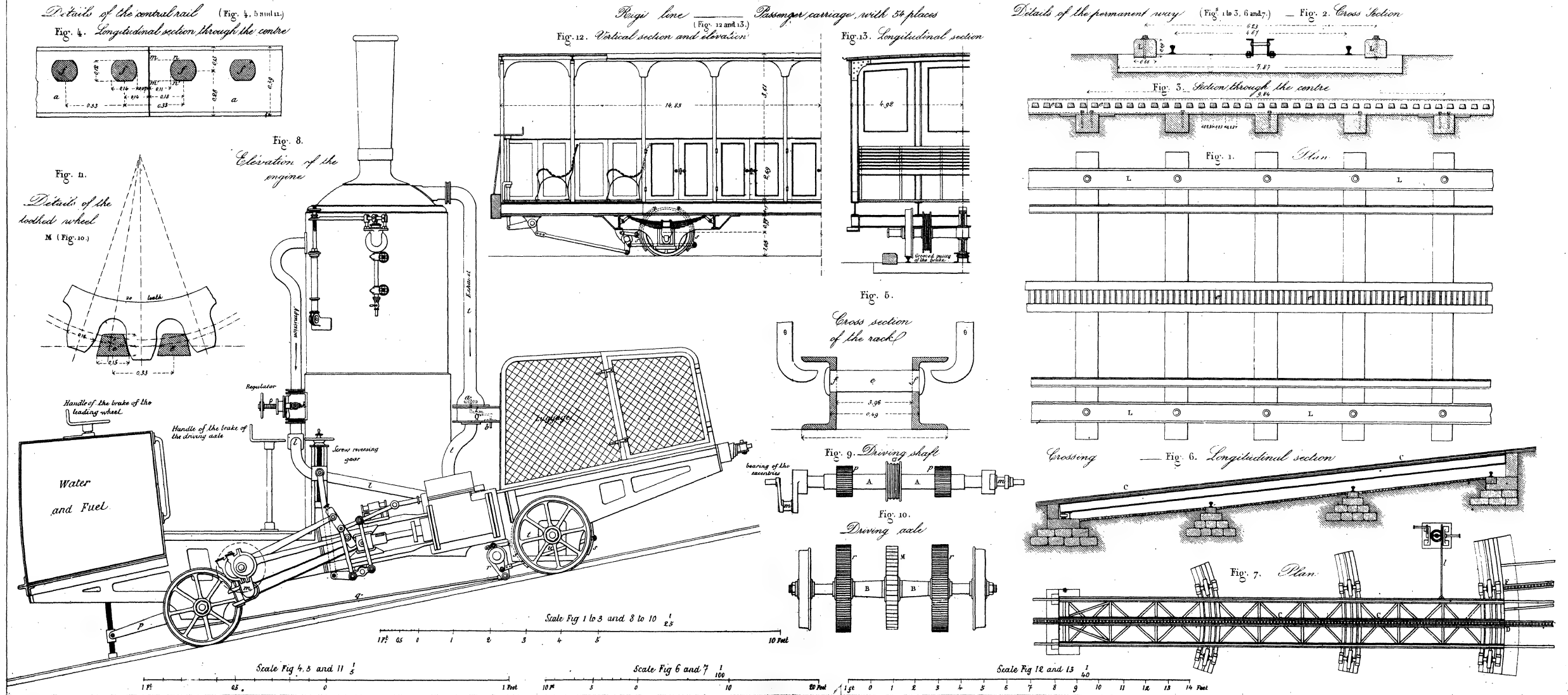
5 Feet 0 5 10 15 20 25 Feet



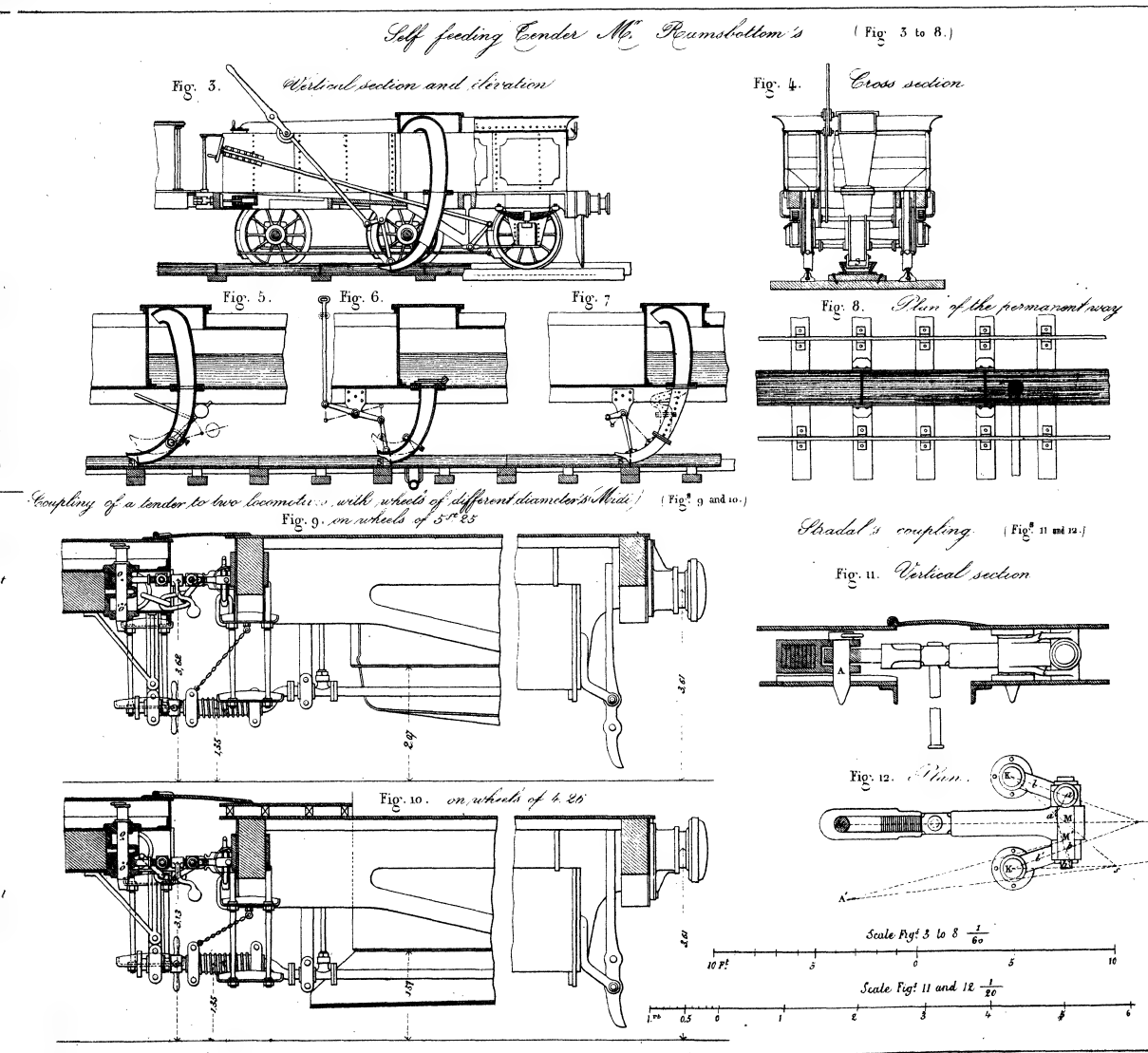
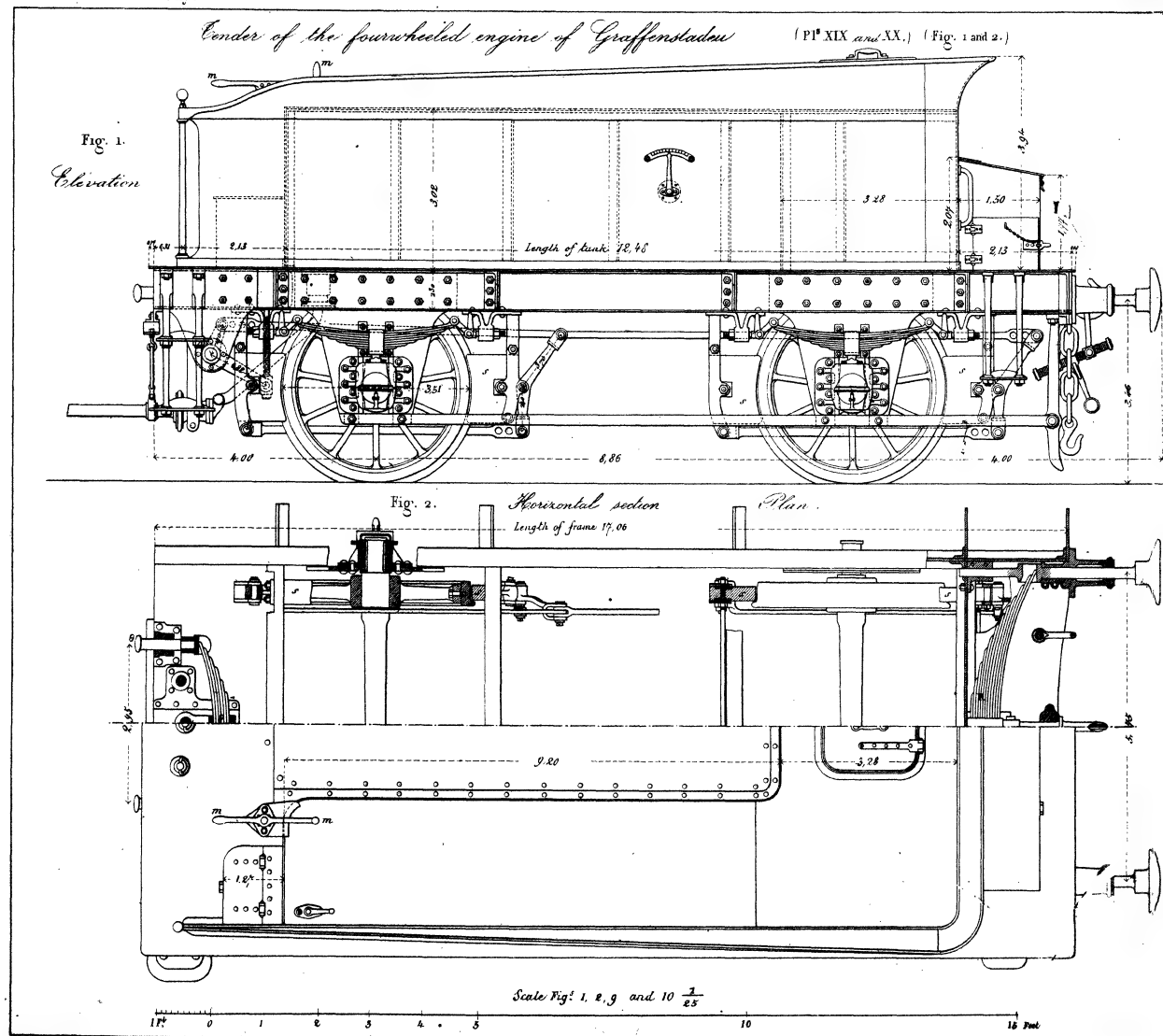




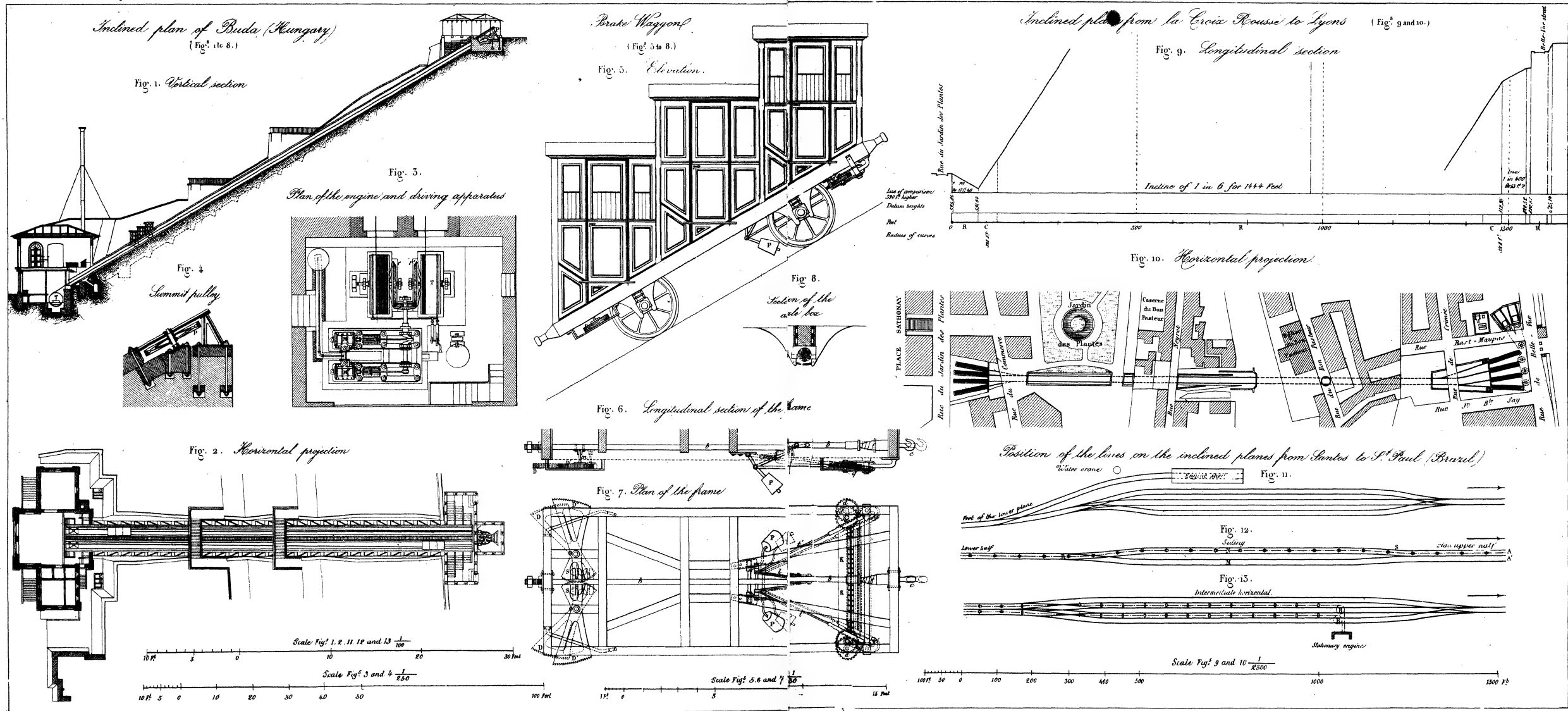














*Frame of the self acting brake of the line from Croix-Rousse (Lyons) (Fig. 1 to 4)*

Fig. 1. Elevation

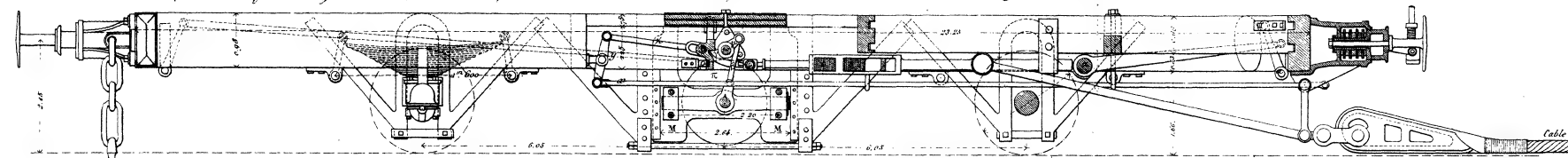


Fig. 2. Plan

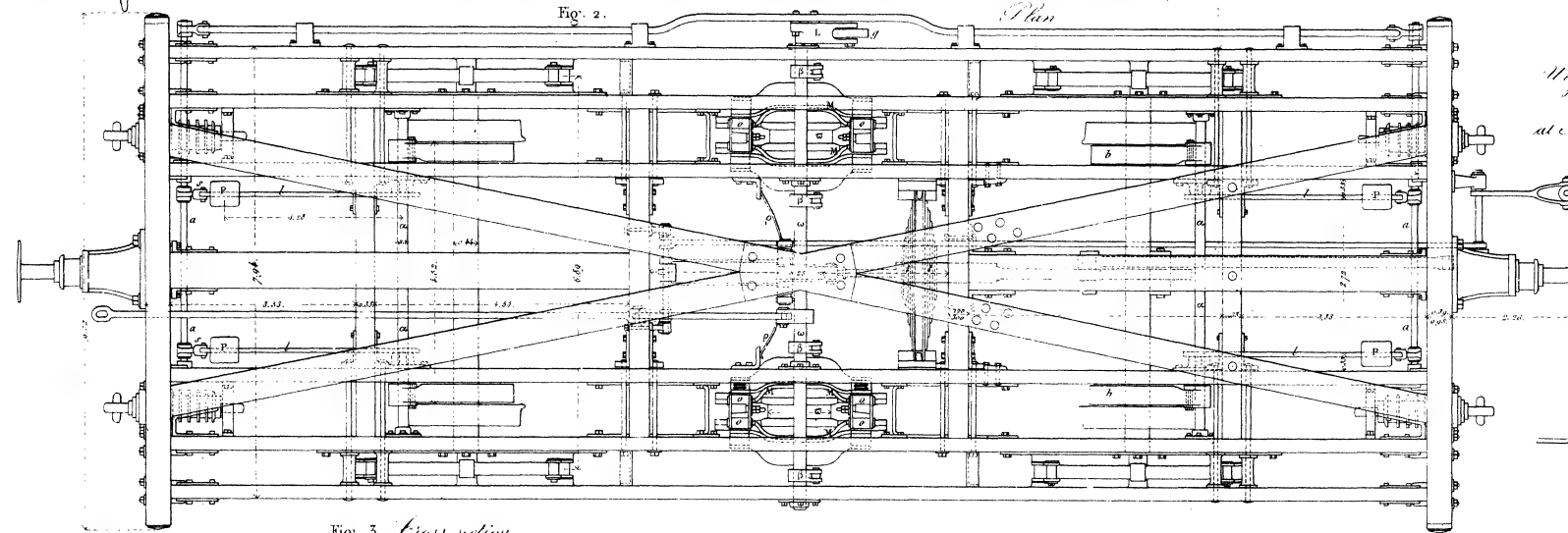


Fig. 3. Cross section

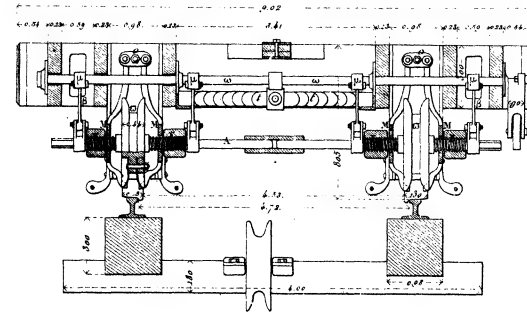
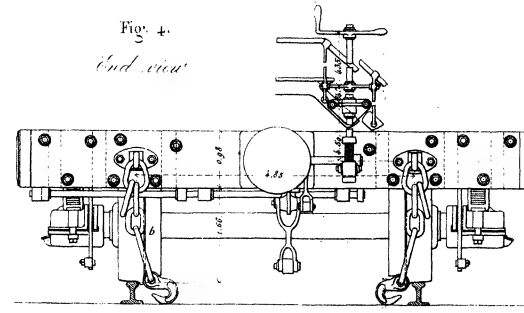
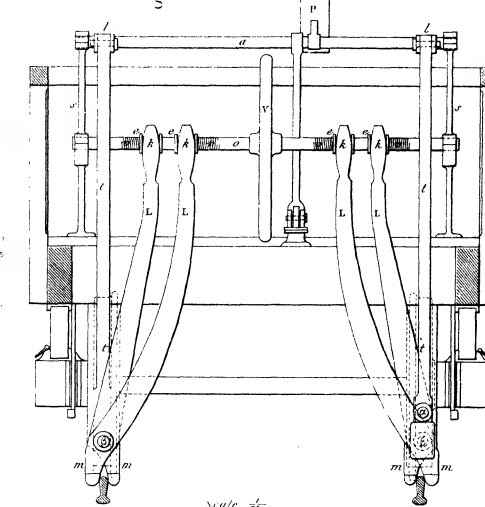


Fig. 4. End view



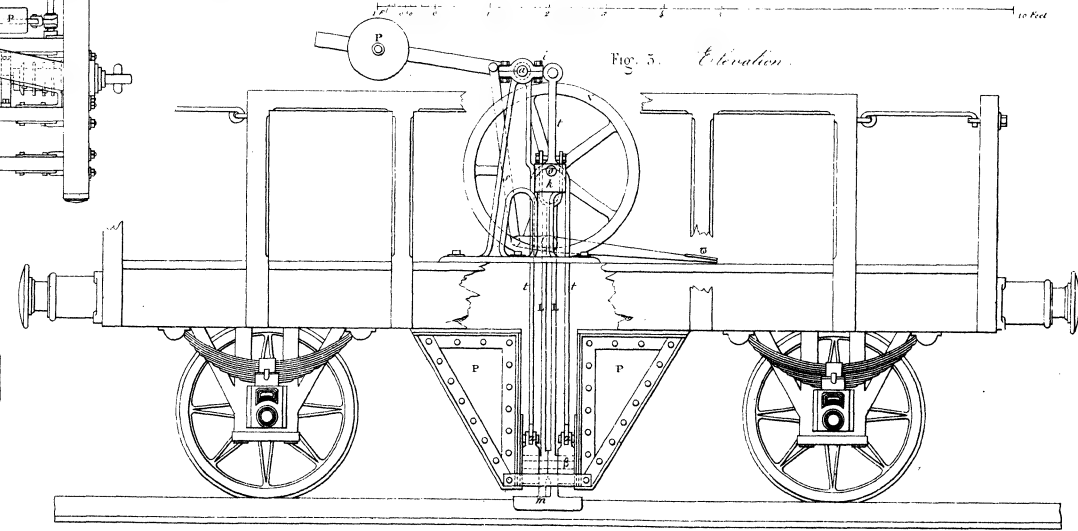
*Wagon with gripping brake of the inclined planes at Santo Paulo (Brazil) (Fig. 5 and 6.)*

Fig. 6. Cross section



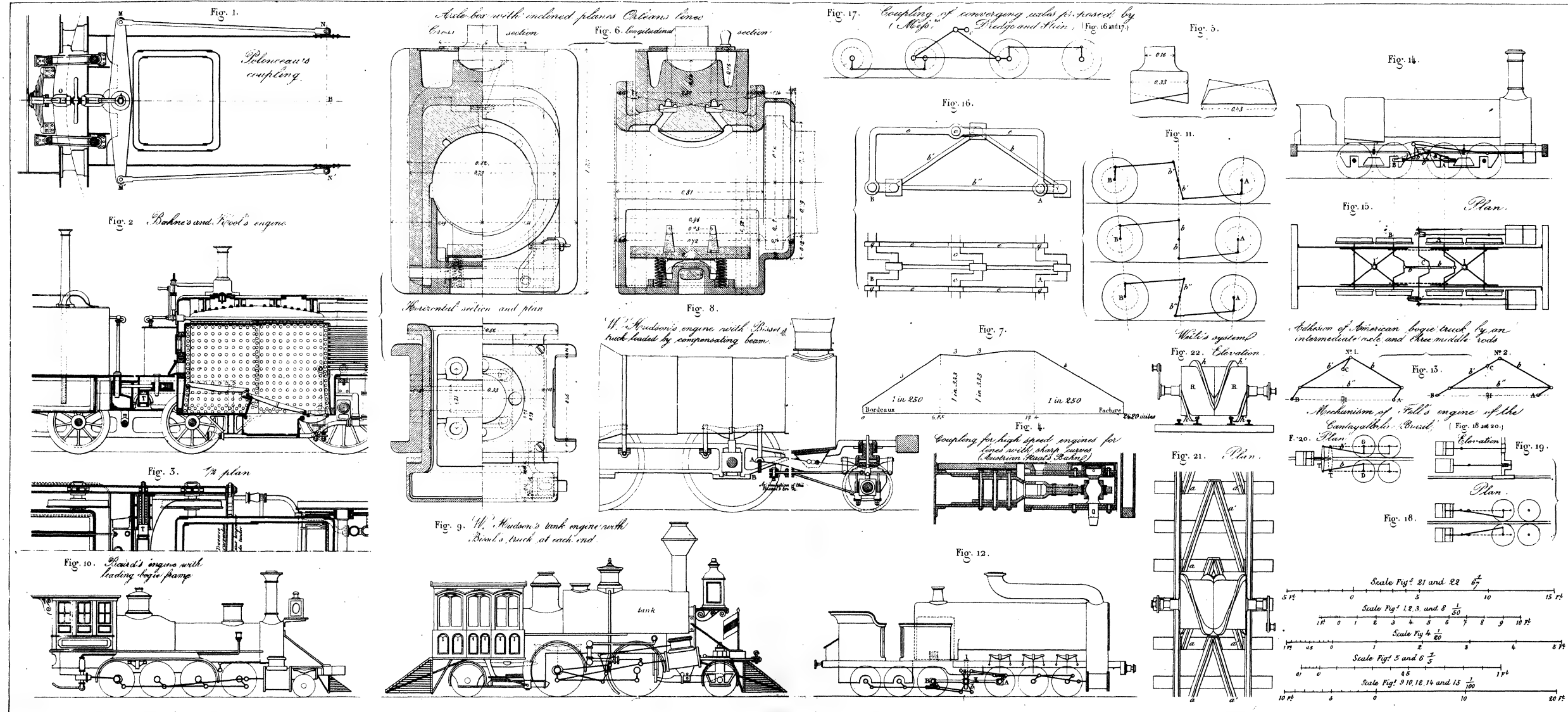
Scale  $\frac{1}{25}$

Fig. 5. Elevation



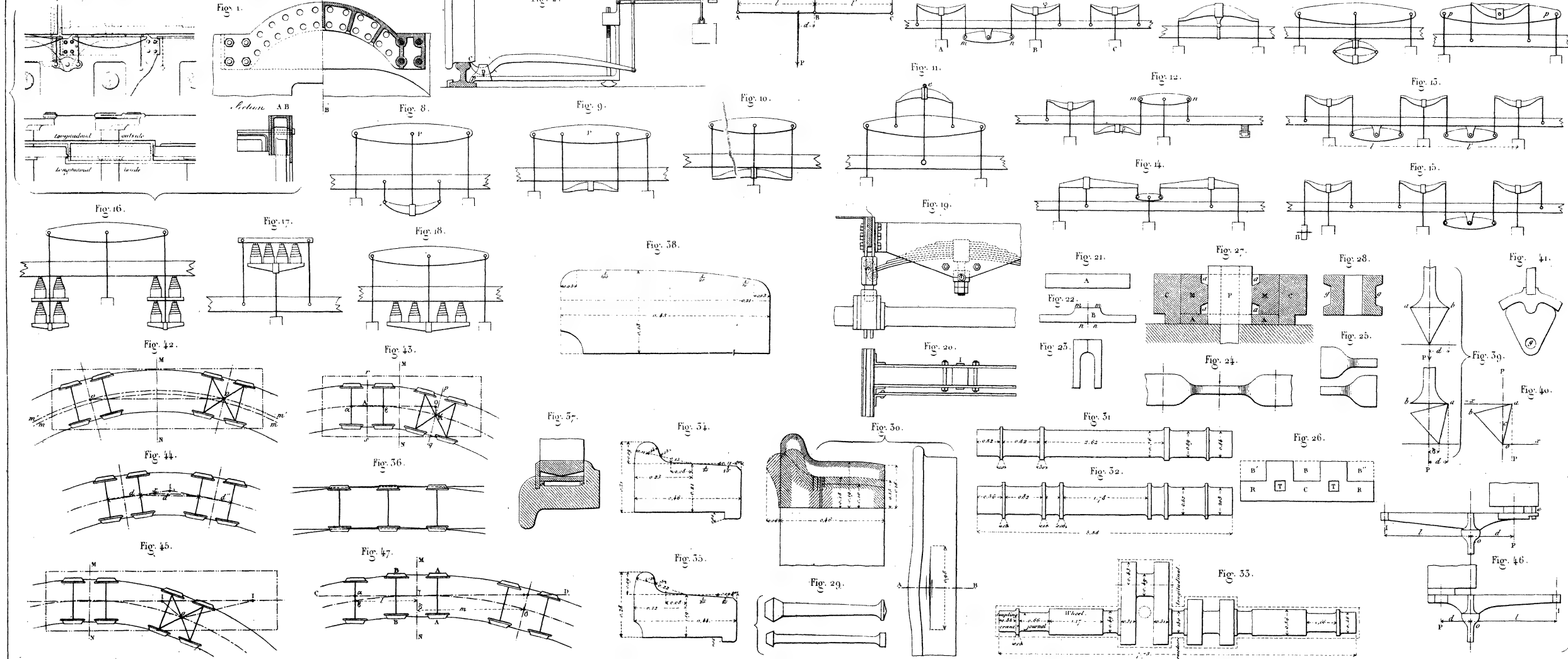




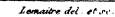




Consolidated engine (Belgian line) the arrangement of inside and outside longitudinal frame plates









*Inclined plane of Lanslebourg*  
Fig. 1.  
*General plan of the turbines and of the transmission* (Fig. 1 to 3.)

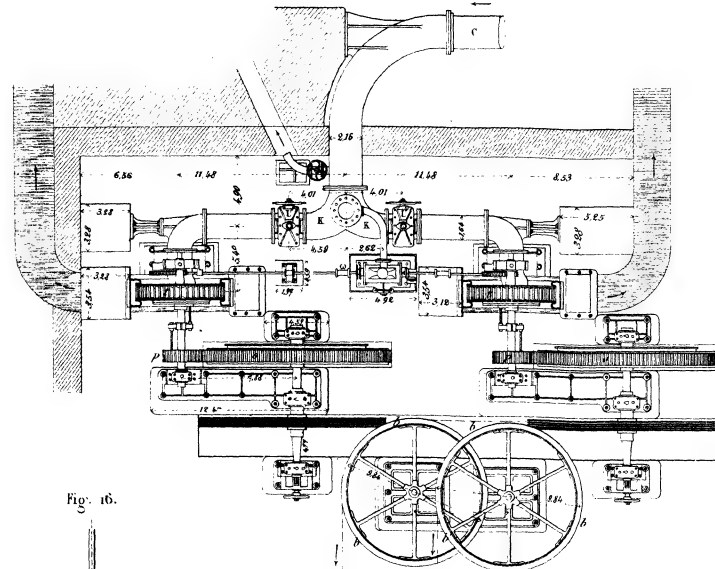
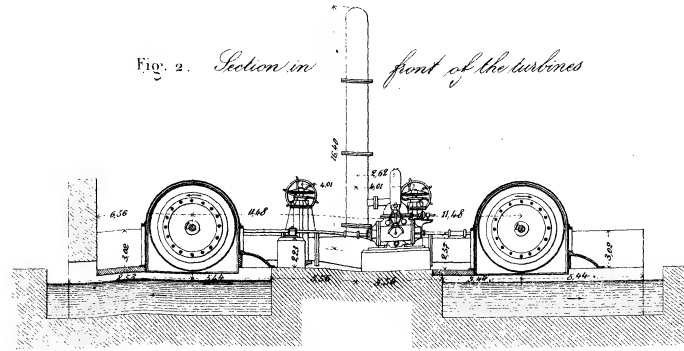


Fig. 2. *Section in front of the turbines*



*Installation of the strainers* (Fig. 4 to 6.)

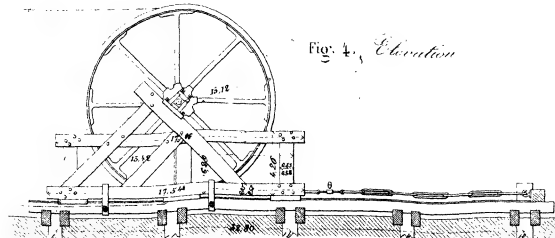


Fig. 6. *Plan*

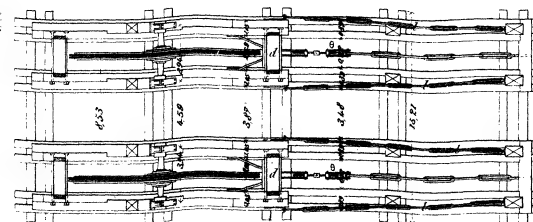
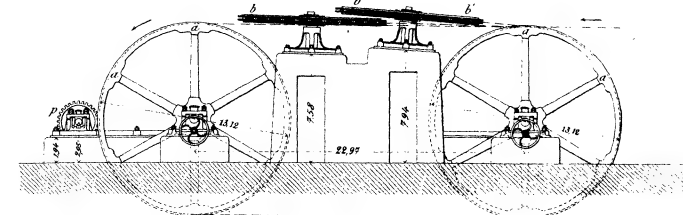


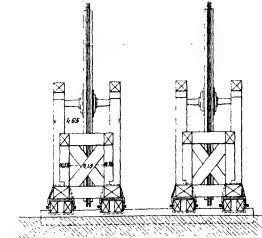
Fig. 3.

*Section in front of the transmitting pulleys*



*Installation of the return pulleys at the top*  
(Fig. 10 to 12.)

Fig. 5. *End view*



*Dynamometer of the strainer* (Fig. 7 to 9.)

Fig. 7. *Longitudinal section*



Fig. 8. *End view*

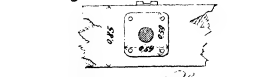


Fig. 9. *Plan*



Fig. 10. *Elevation*

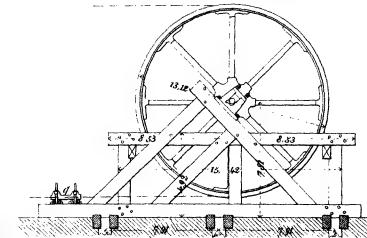
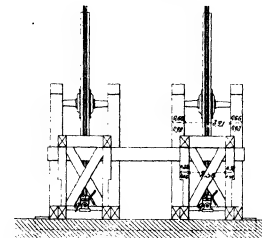


Fig. 11. *End view*



*Stopping dcp. of the rope* (Fig. 13 to 15.)

Fig. 13. *Front view*

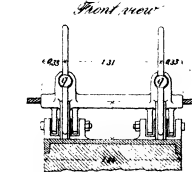


Fig. 14. *End view*

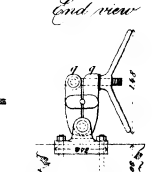


Fig. 15. *Plan*

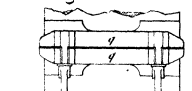


Fig. 16.

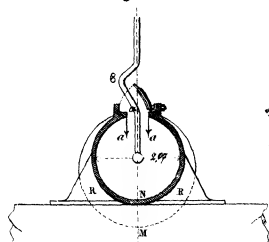


Fig. 17.

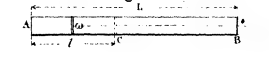


Fig. 19.

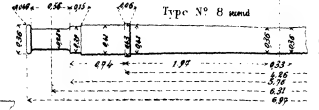


Fig. 20.

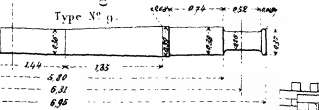
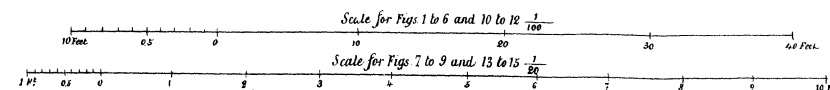
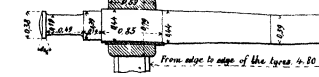


Fig. 18.











Locomotor system of 1867. (Fig's 5 and 6.)

Fig. 5. *Elevation*

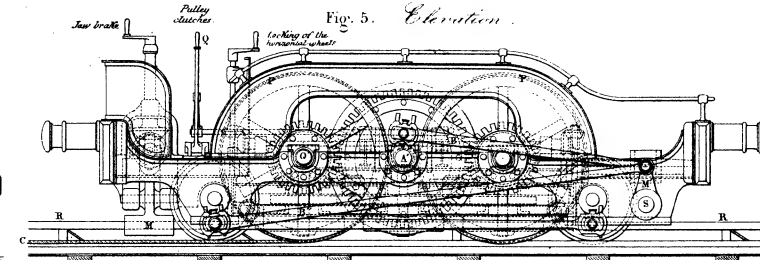


Fig. 6. Plan.

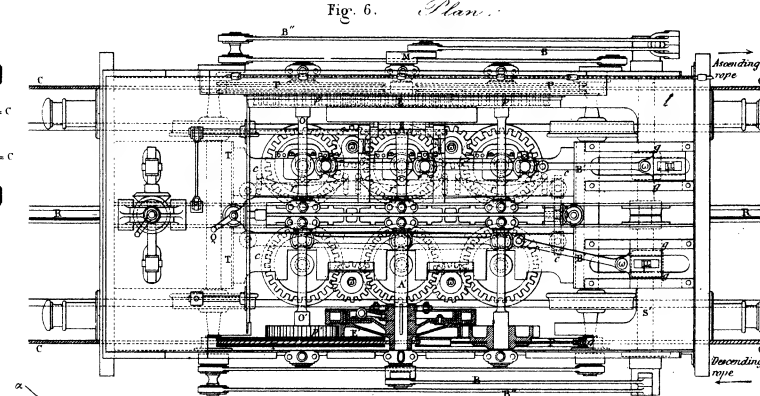


Fig. 15

Fig. 11.

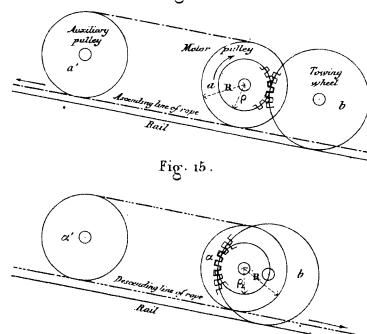
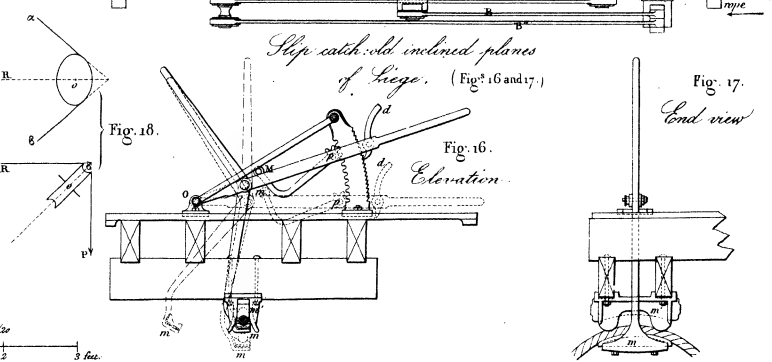


Fig. 17.  
End view

Fig. 16.



Lemaître del. et sc.



*Railway from Bilbao to Tudela (Spain)*  
crossing of the Cantabric Pyrenees

Fig. 1. Longitudinal section.

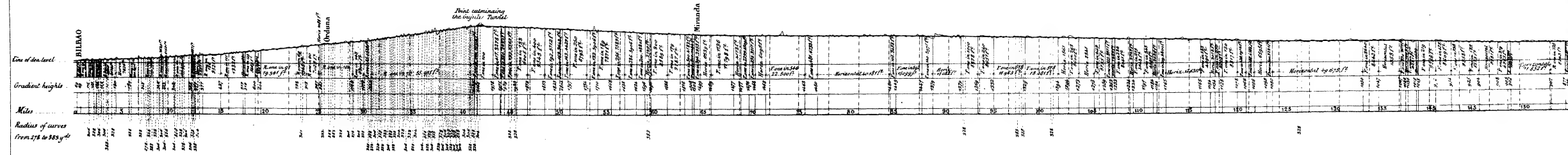


Fig. 3. Railway from Düsseldorf to Elberfeld.

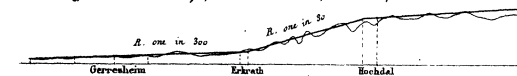


Fig. 4. Railway from Brunswick to Hildesheim.

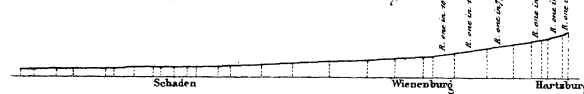


Fig. 5. Railway from Paris to St. Germain.

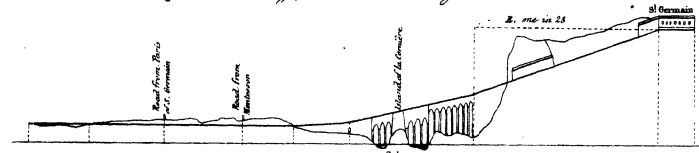


Fig. 6. Railway from Paris to Lyons (section comprised between the towns of Dijon and Lyon).

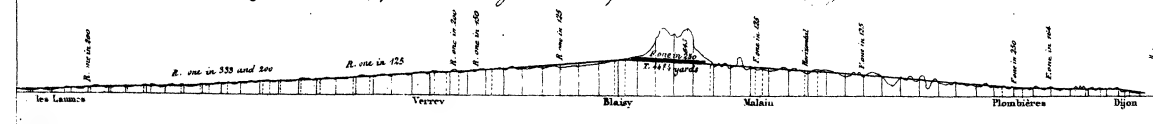
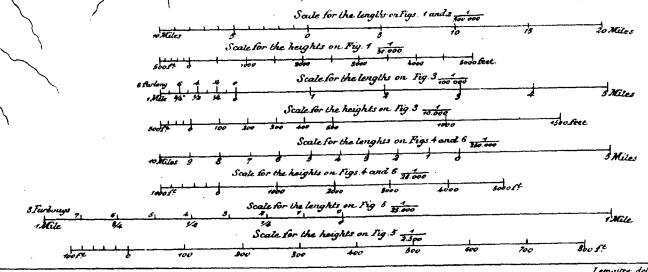
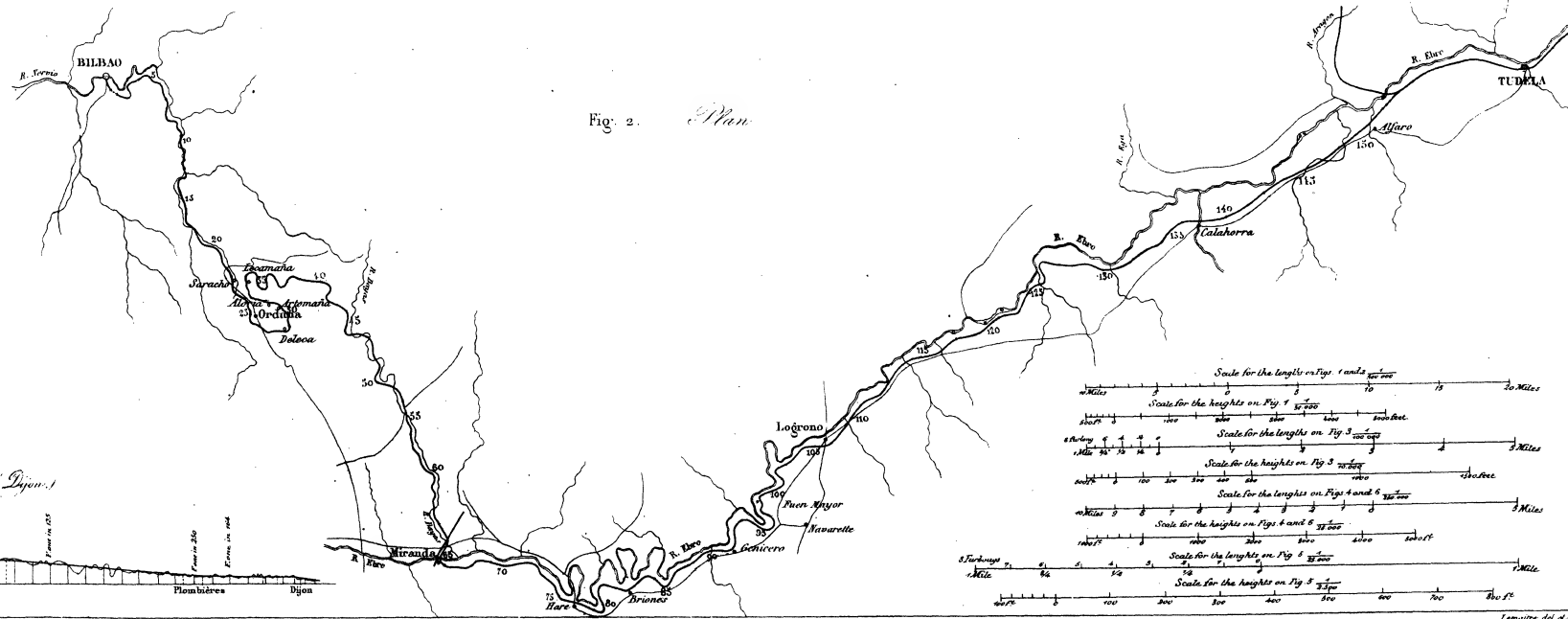
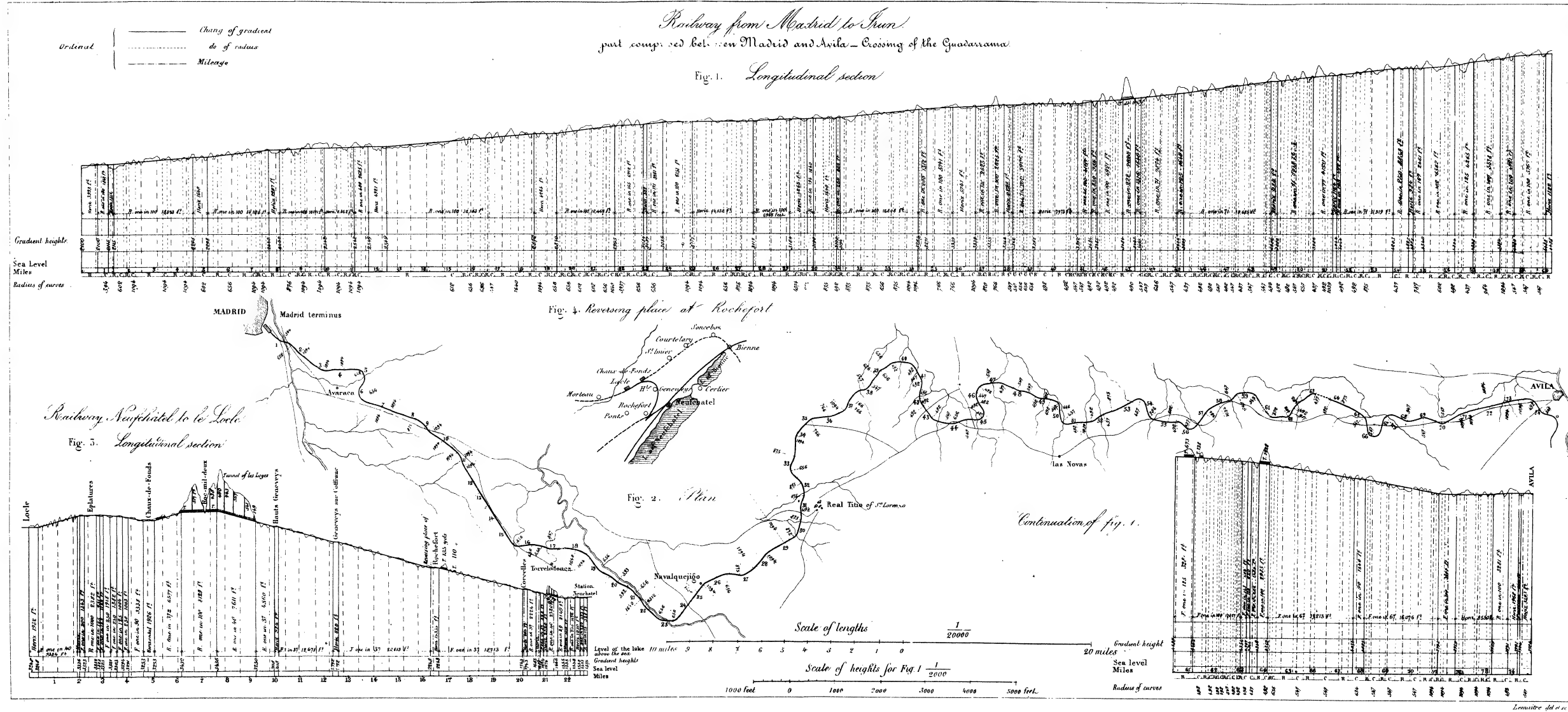


Fig. 2. Plan.











*Railway from Madrid to Iruñe part comprised between Avila and Valladolid*  
 Fig. 1. *Longitudinal section*

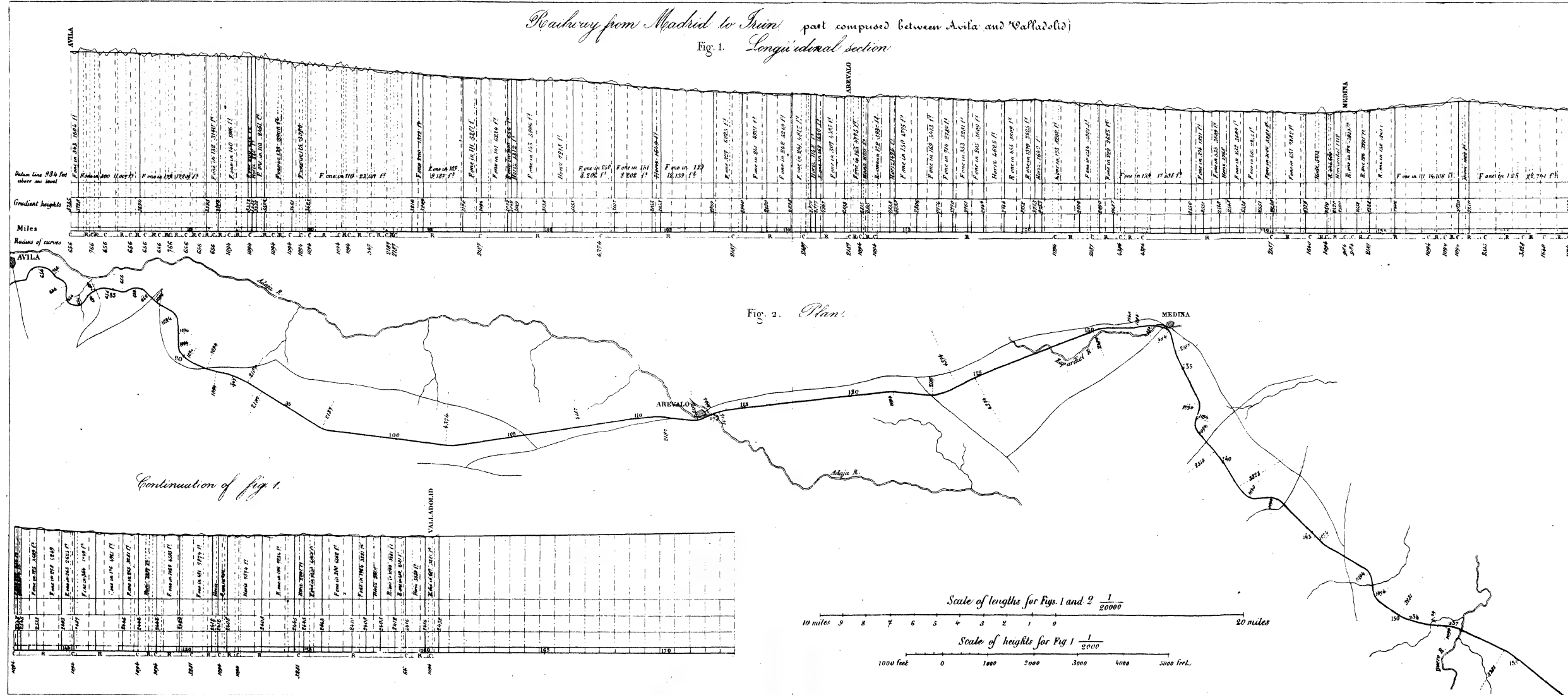
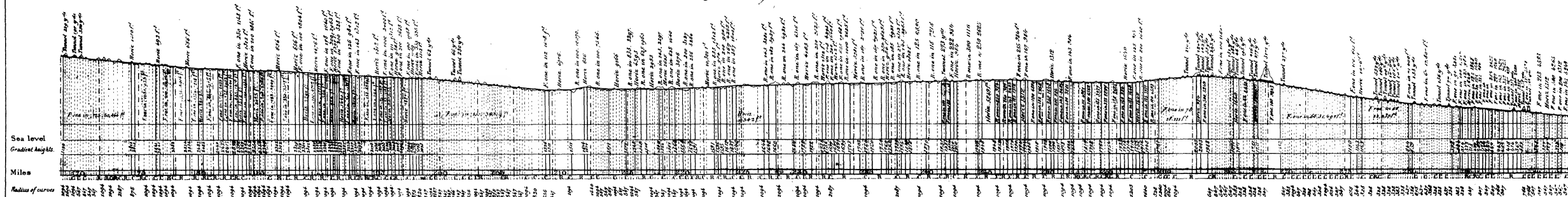


Fig. 2. *Plan*

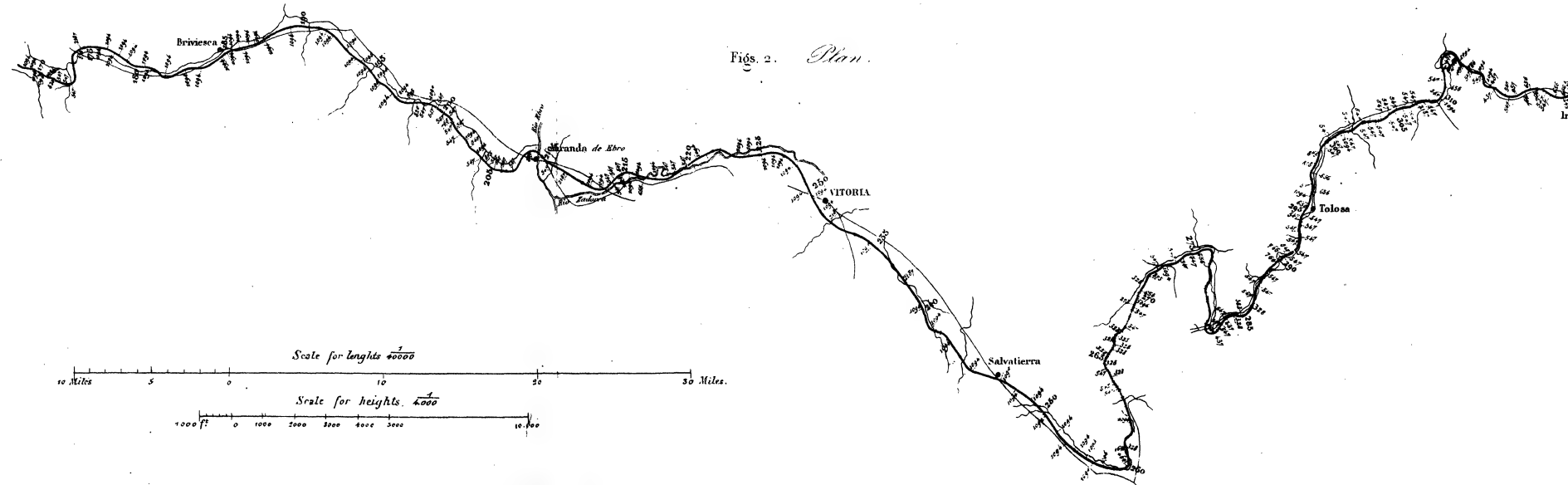


*Railway from Madrid to Irun.*  
part comprised between the 168<sup>th</sup> mile and Irun, crossing of the Pyrenées.

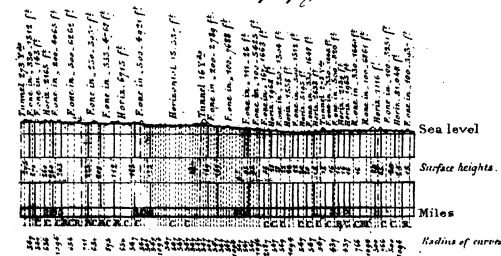
Figs. 1. Longitudinal section.



Figs. 2. Plan.



continuation of fig. 1.





*Orleans Railway*  
line from Moulines to Montluçon.

Fig. 1. *Longitudinal section.*

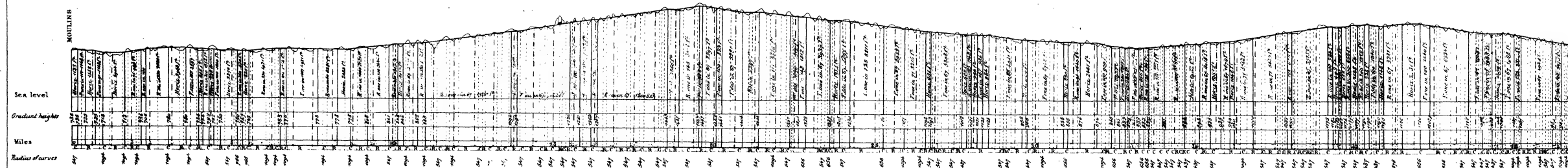


Fig. 3. *Section of the Bezenet branch*

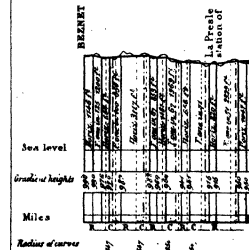


Fig. 4. *Connection of the St Jacques works with the line.*

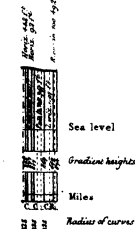
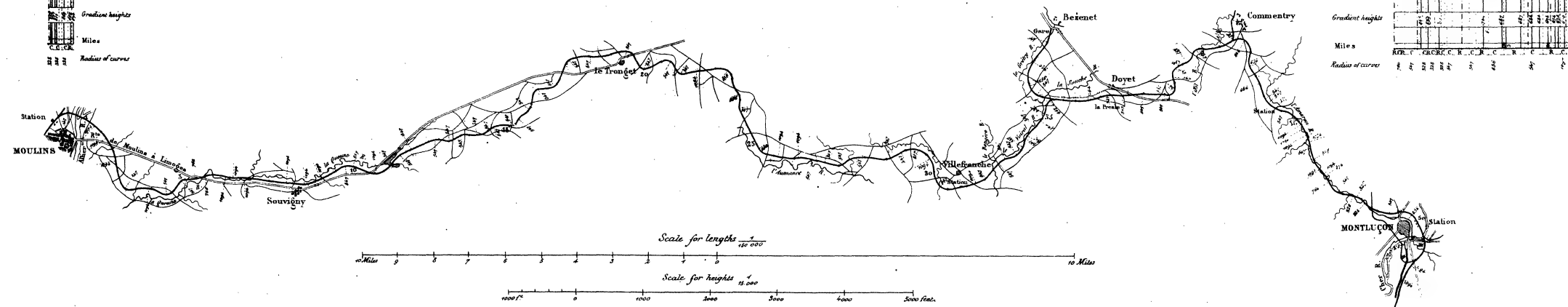


Fig. 2. *Plan*



*Continuation of fig. 1.*

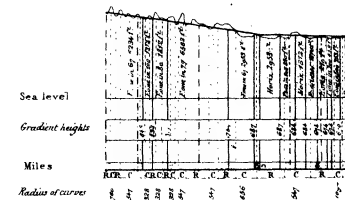






Fig. 1. Longitudinal section.

Fig. 2. Plan.

Lemaitre del. et sc.





*Railway from Santander to Alar del Rey (Spain)*  
 Section from Barcena to Reinosa... (Crossing of the Pyrenees)

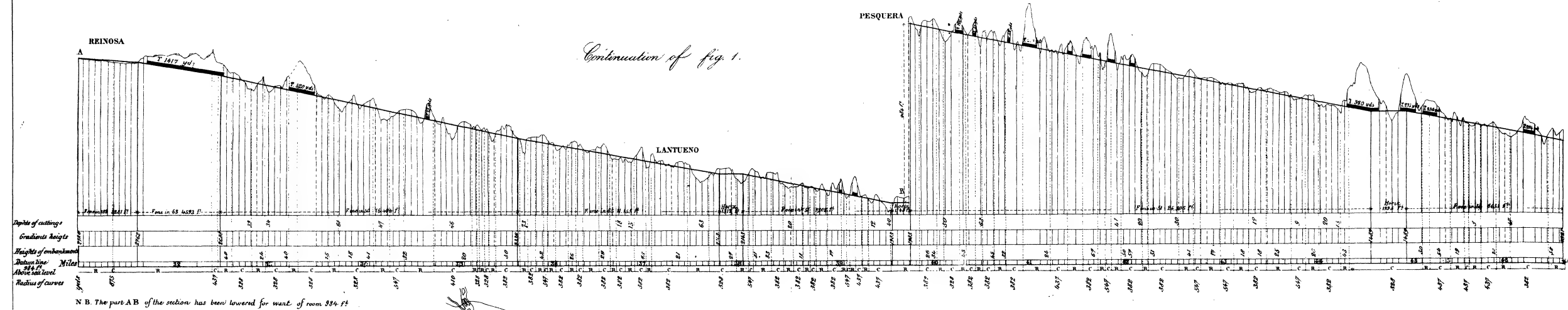


Fig. 1. Longitudinal section

N.B. The want of height did not permit the ordinates of this section to be reckoned from the level of the sea. They refer to a datum line 656 ft above

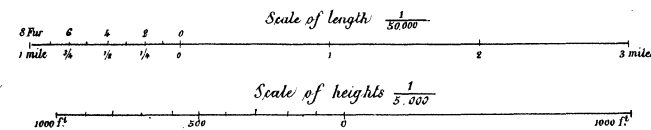
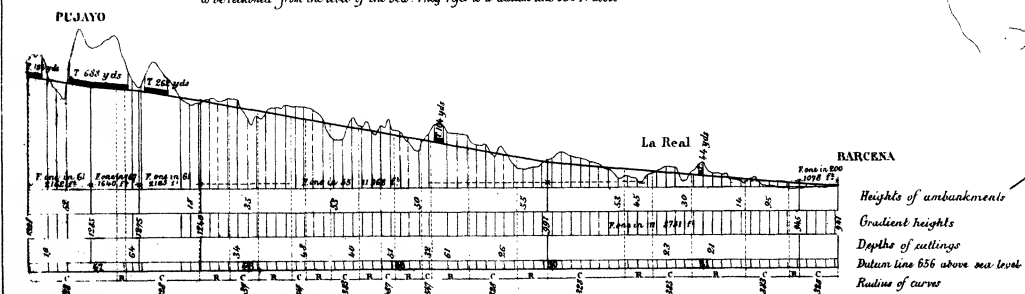
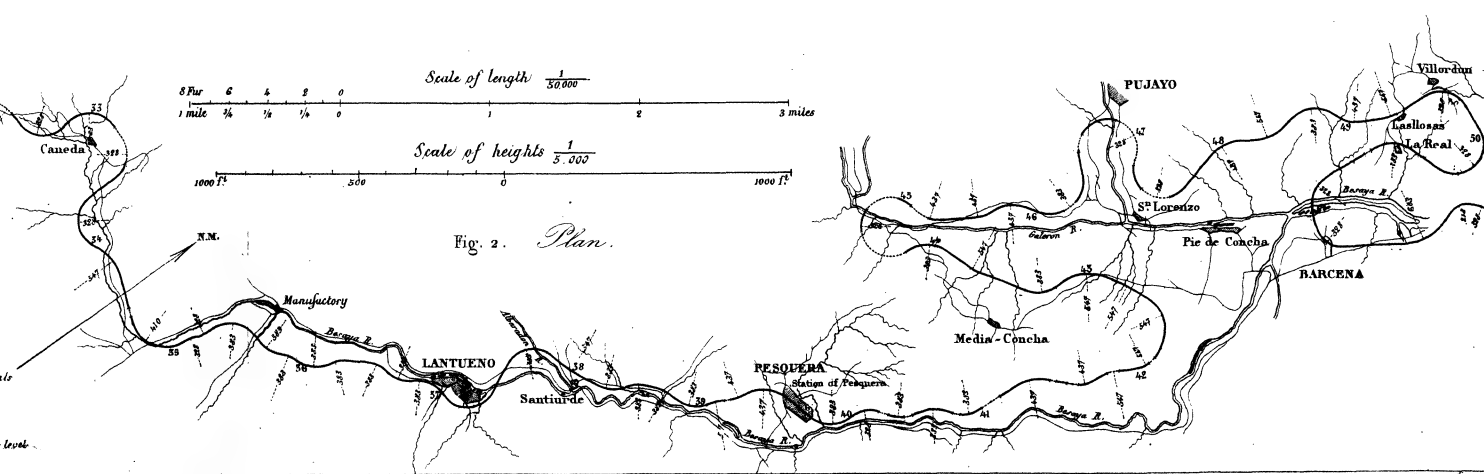


Fig. 2. Plan





Vol. II. Pl. XCIX.

Fig. 1

Fig. 1. *Longitudinal section*

*Pacific line*, (part comprised between Omaha and San-Francisco)

1 Union - Pacific and Central - Pacific  
(ayote)

*North Platte*

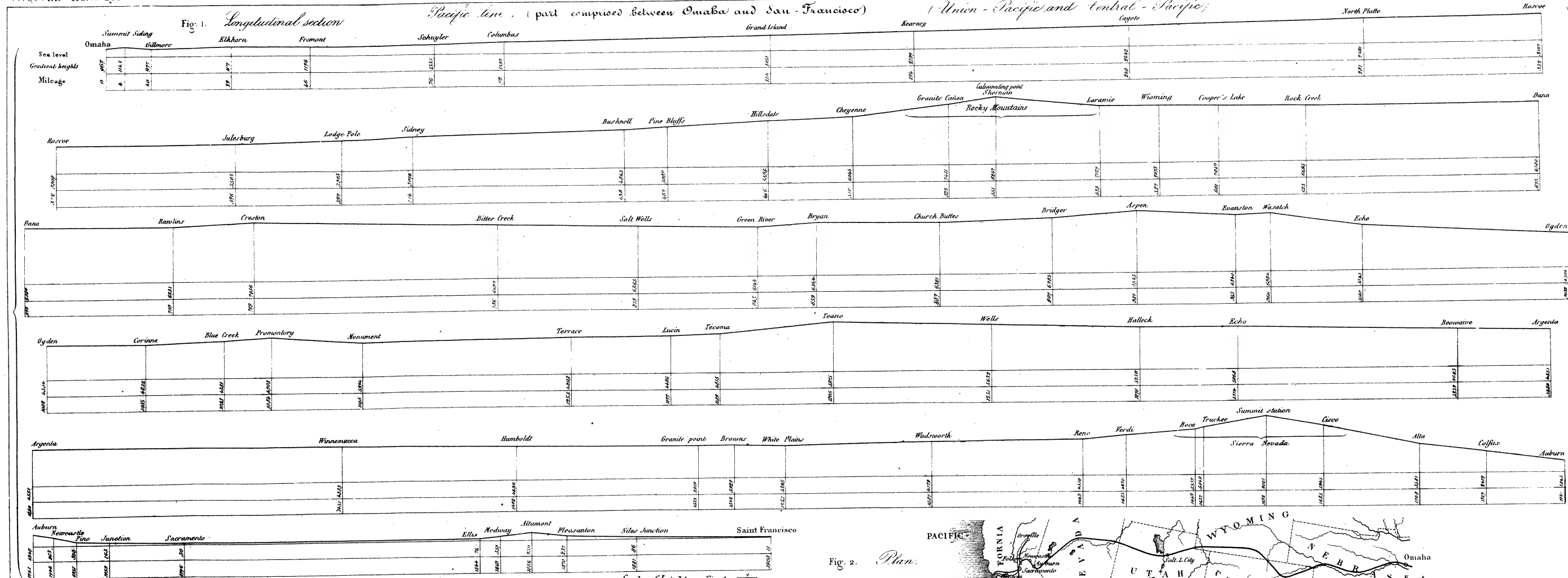
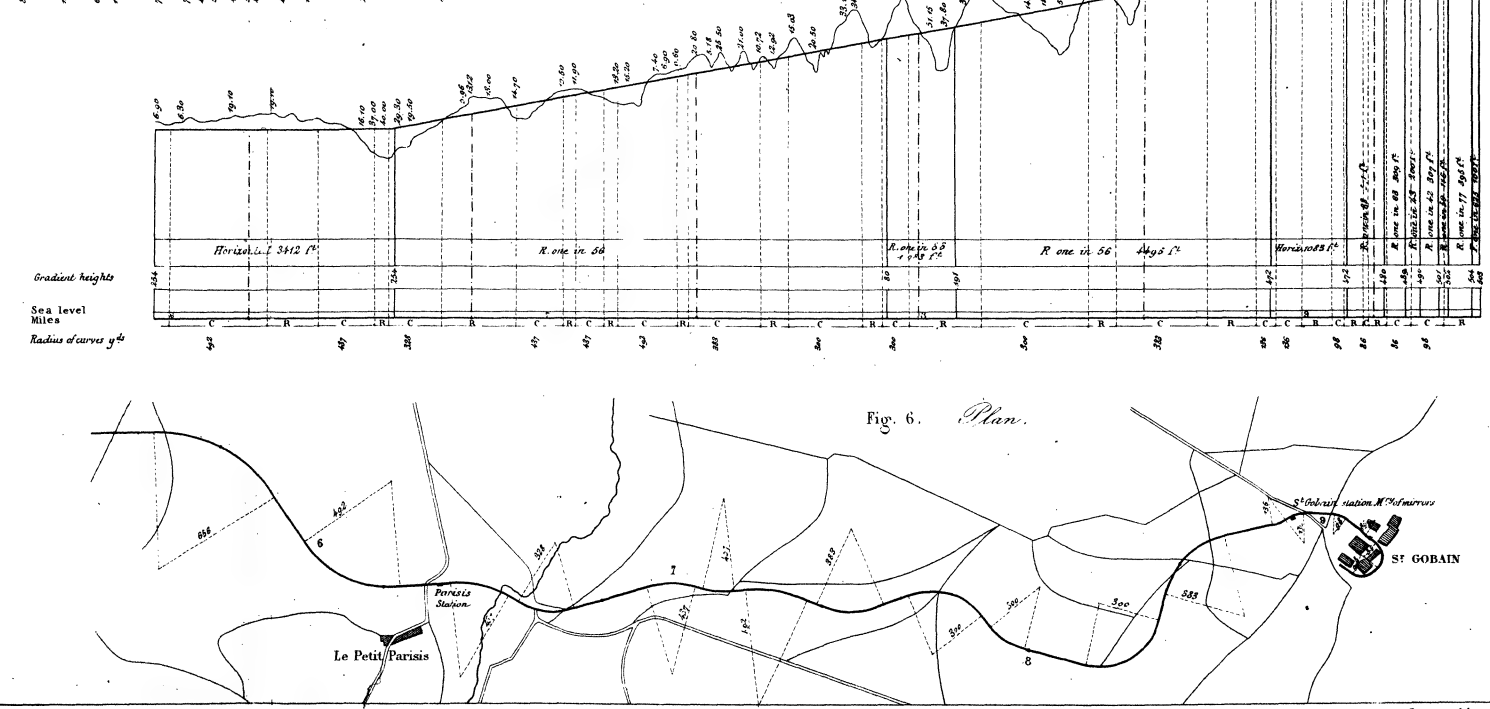
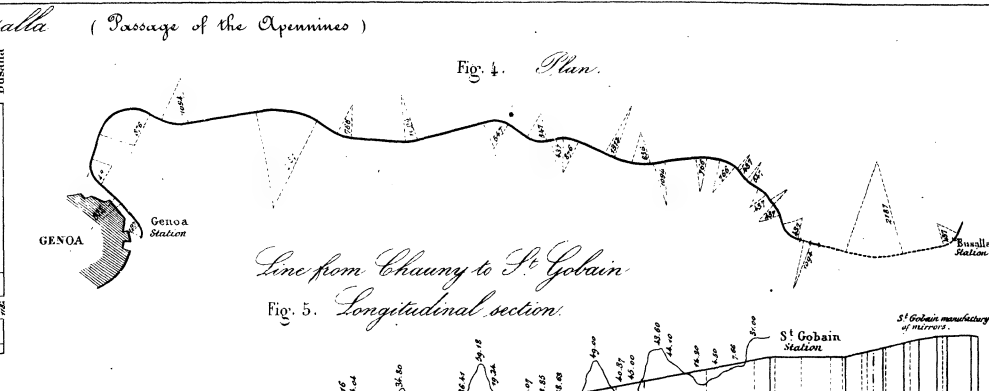
*Roscoe*

Fig. 2. *Plan*

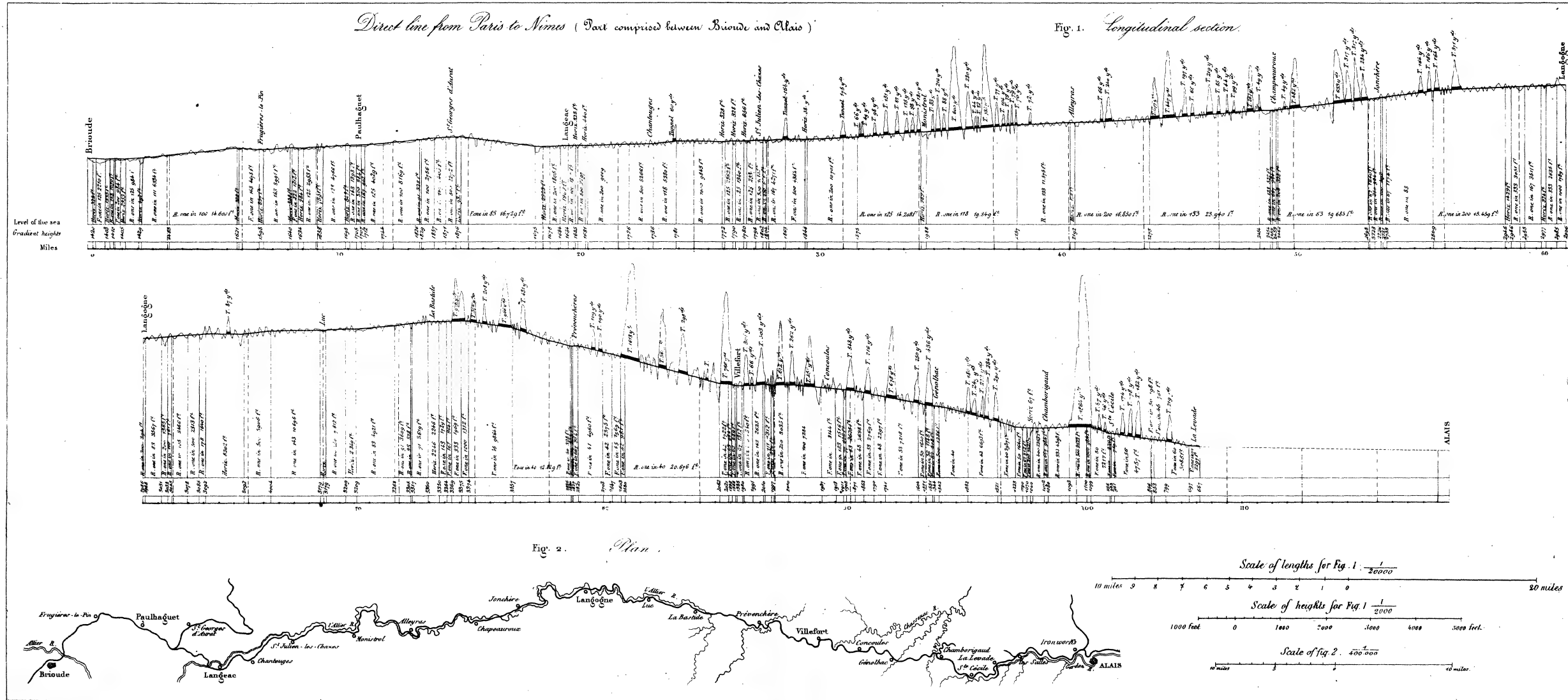


Lemaître del. et sc.



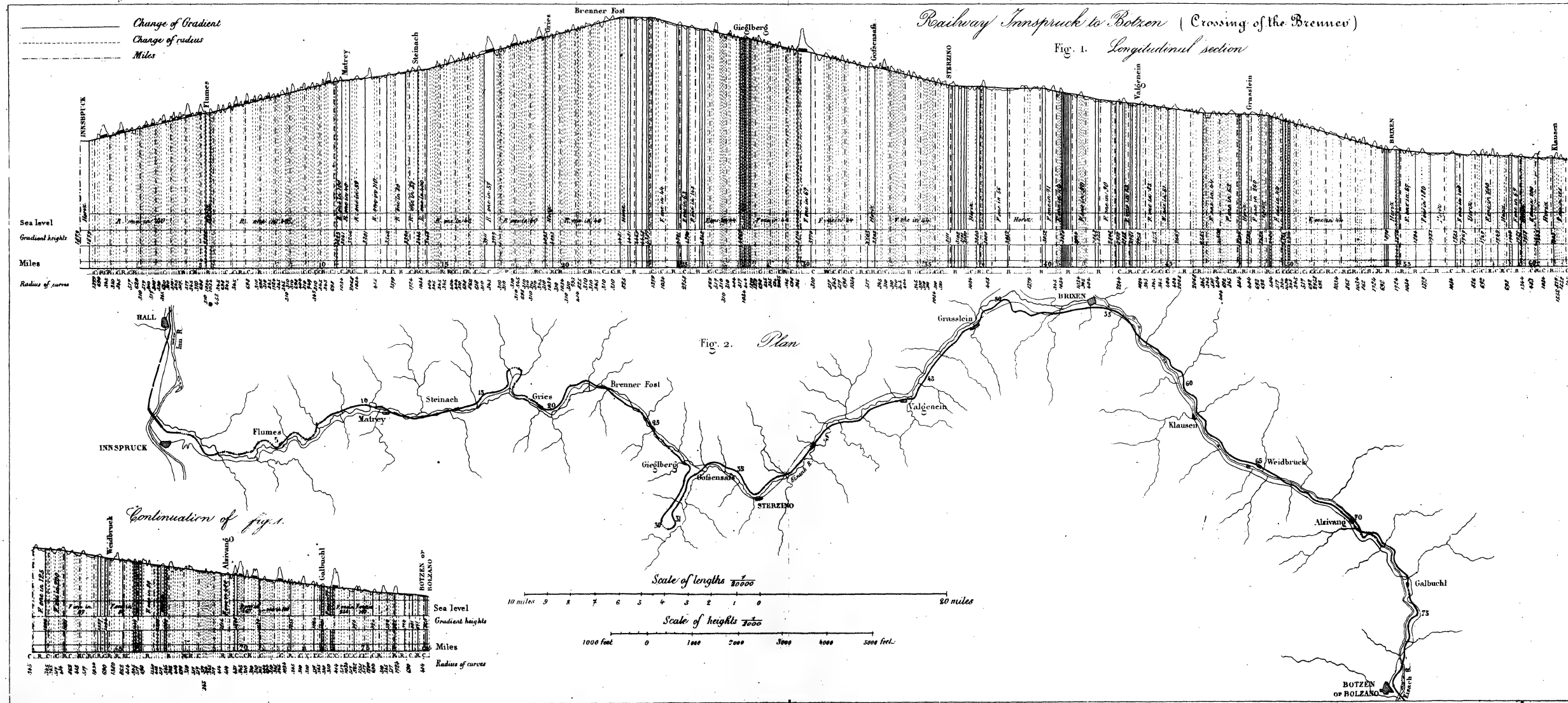






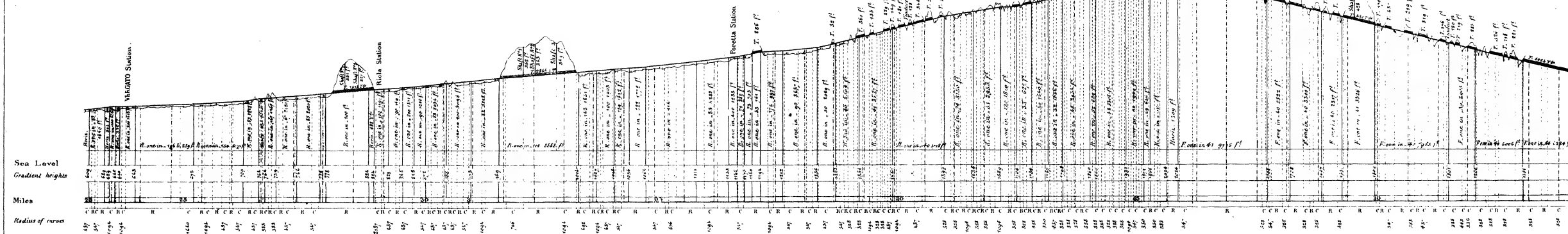
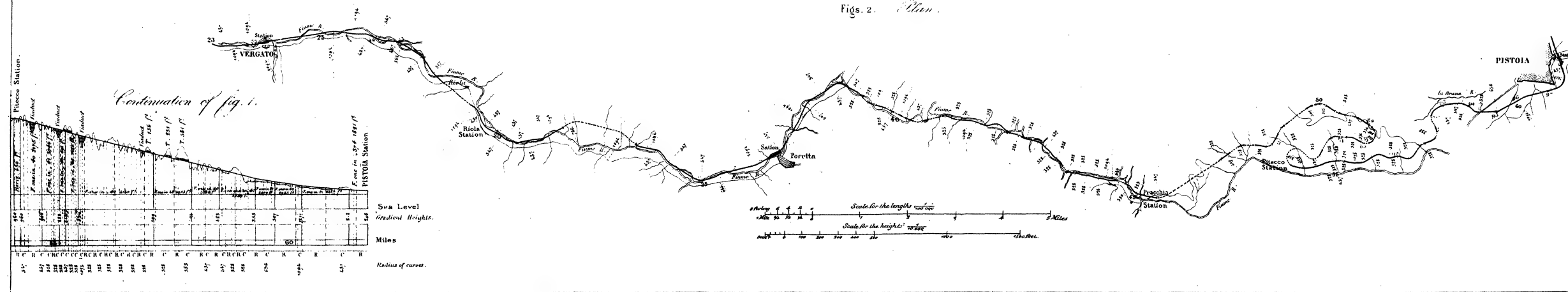








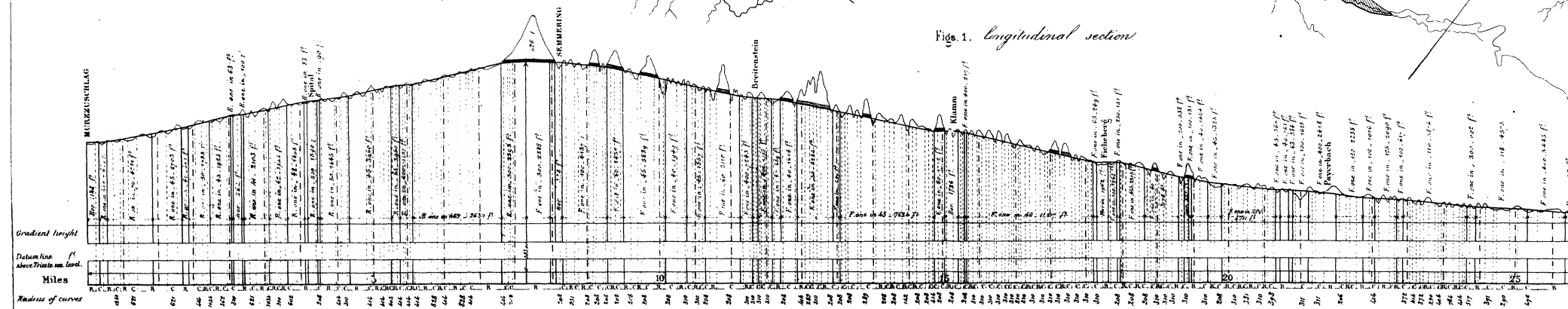
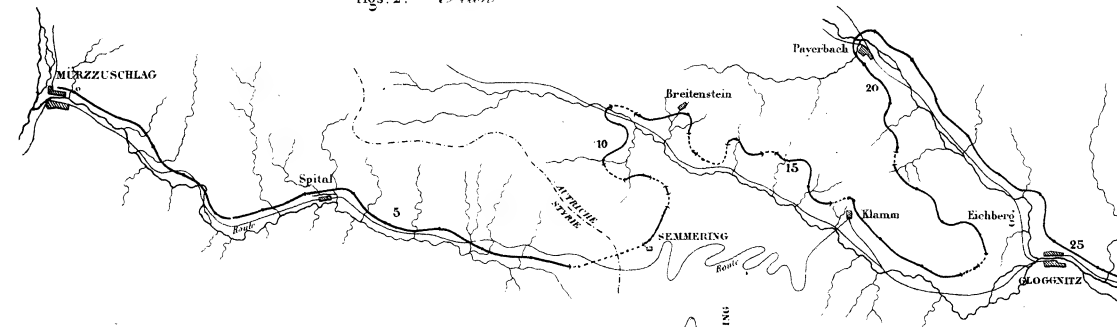
*Lombardy and Central Italy Railway.*  
part comprised between Vergato and Pistoia — crossing of the Apennines.

Figs. 1. *Longitudinal Section.*Figs. 2. *Plan.*



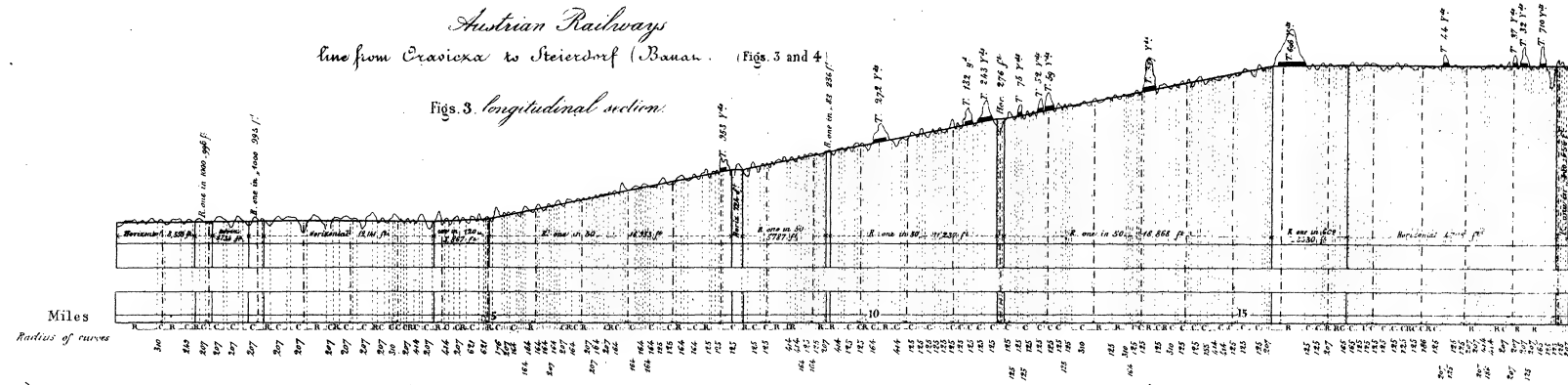
*Austrian Railways*  
Section from Murzzuschlag to Gloggnitz. (passage of the Semmering.) (Figs. 1 and 2)

Figs. 2. Plan

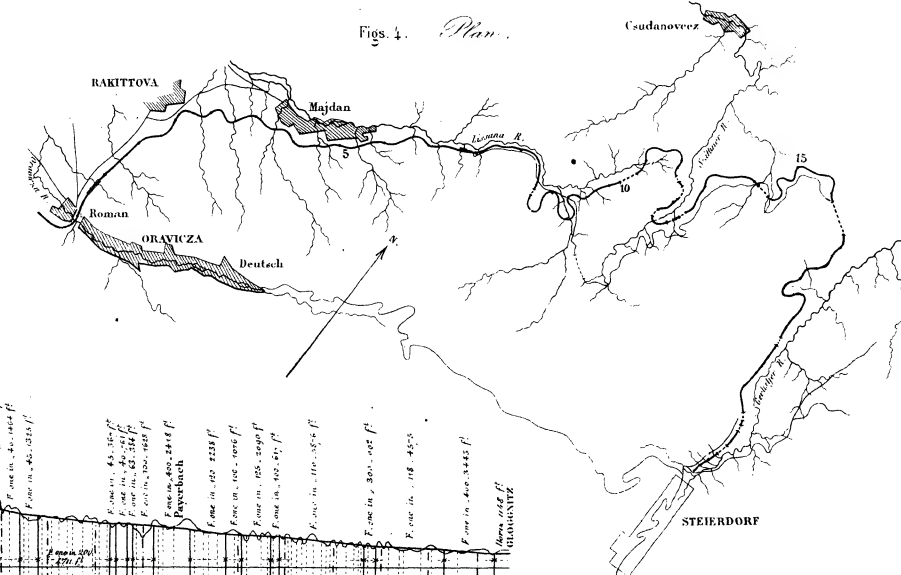


*Austrian Railways*  
Line from Cravieva to Steierdorf (Bauan). (Figs. 3 and 4)

Figs. 3. Longitudinal section



Figs. 4. Plan



Figs. 1. Longitudinal section



Fig. 1. Forbach to Niederbronn.

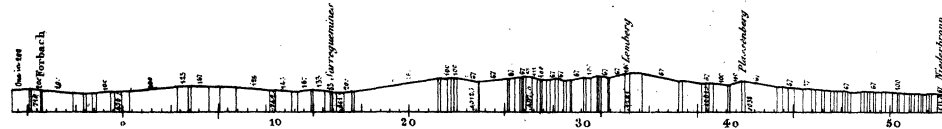


Fig. 2. Metz to Hieson.

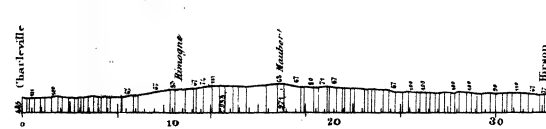


Fig. 3. Chaumont to Pagny-sur-Meuse.

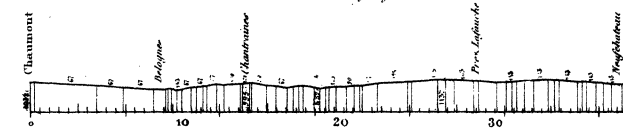


Fig. 4. Chaumont to Châtillon-sur-Seine.

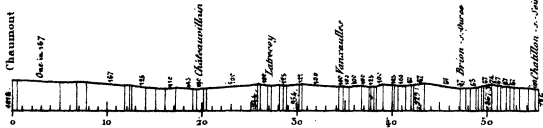


Fig. 5. Livron to Privas.

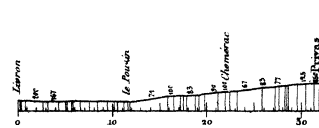


Fig. 6. Lyons (Perrache) to Grenoble.

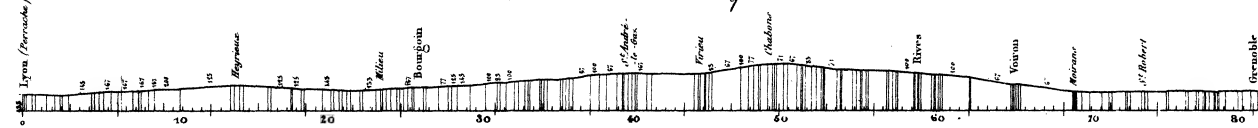


Fig. 7. Châlons to S. Ménéould.

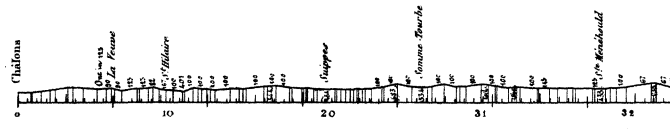


Fig. 8. Pertuis to Marseille.

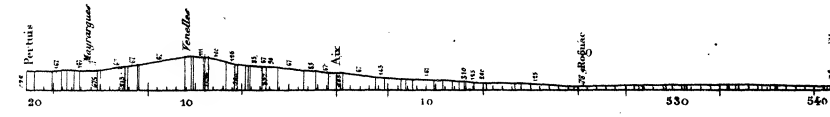


Fig. 11. Aubagne to Valbonne.

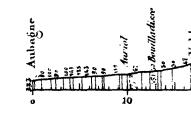


Fig. 9. Dole to Pontarlier.

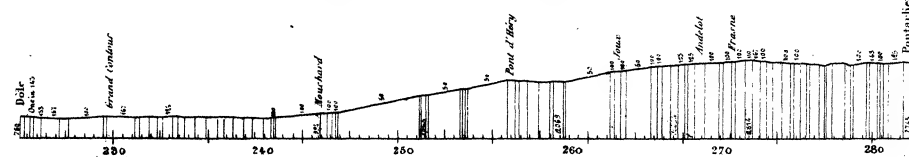


Fig. 12. Luxembourg to Spa and to Lerviers.

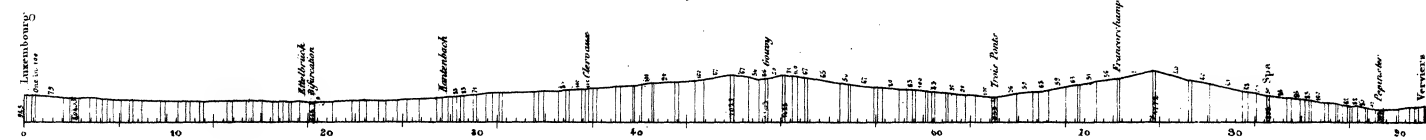
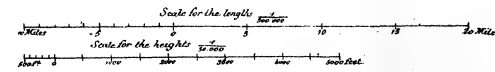
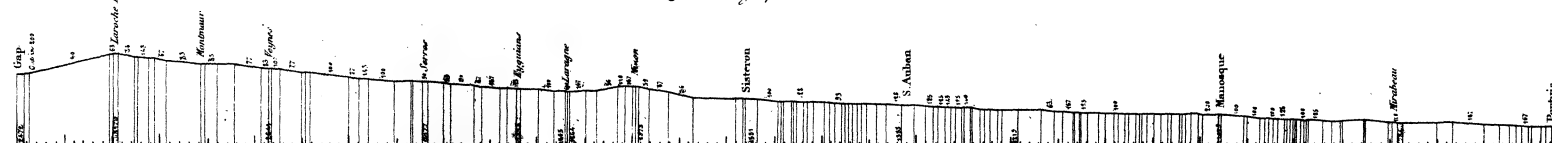


Fig. 10. Clermont-Ferrand to Chiers.



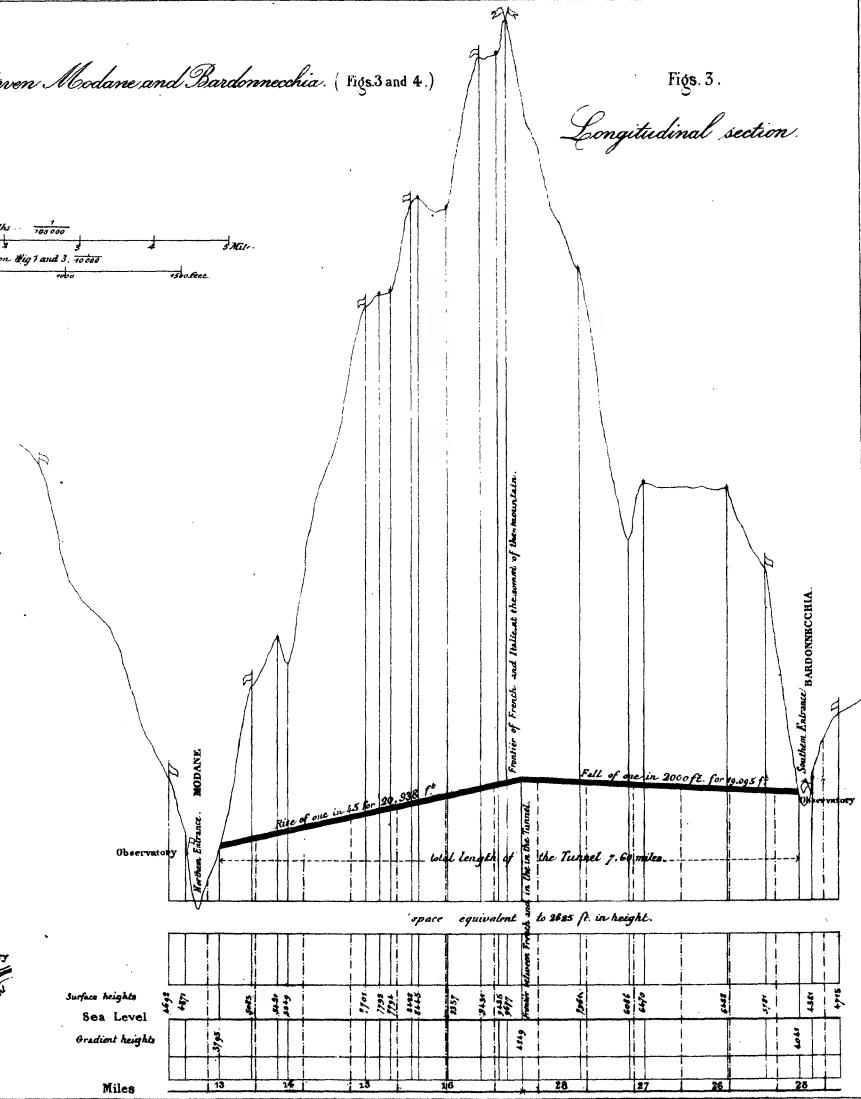
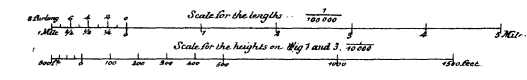
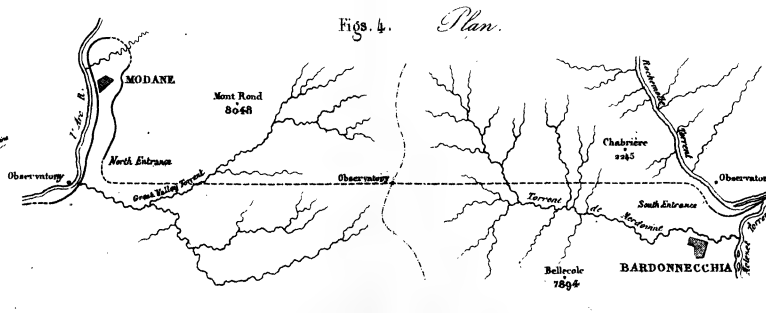
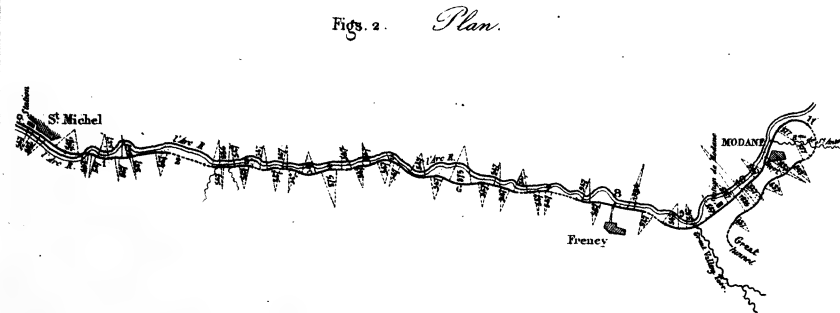
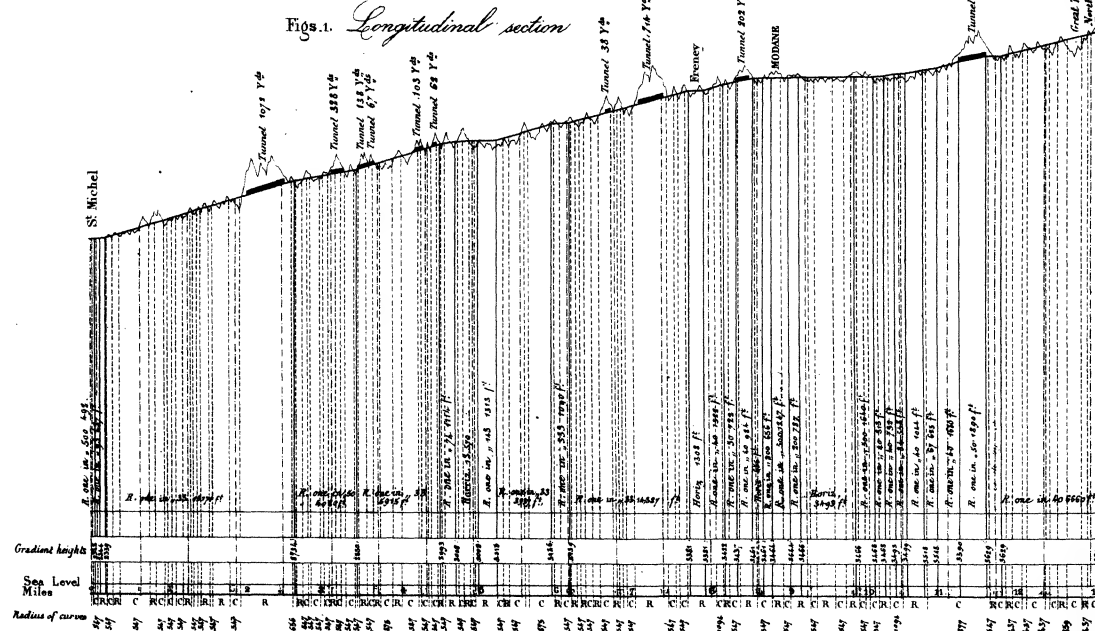
Fig. 13. Gap to Pertuis.







*Crossing of the Alps by Mont Cenis. (Figures.)*  
*French part comprised between St. Michel and the great tunnel* (Figs. 1 to 2.)  
*Great tunnel comprised between Modane and Bardonnecchia.* (Figs. 3 and 4.)





*Crossing of the Alps by Mont Cenis. (Italian portion comprised between the great Tunnel and Bussoleno.)*

